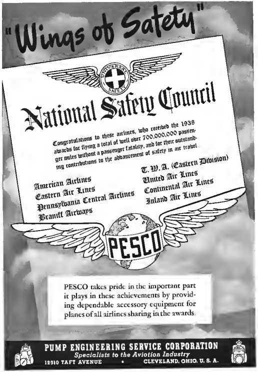
McGraw-Hill Publishing Company, Inc. MAY, 1939 Price 35c. per copy

AVIATION

The Oldest American Aeronautical Magazine

Published monthly, price [illegible] a copy. Subscription rates—United States, Canada, Mexico and Central American Countries, [illegible] a year. All other countries $5.00 a year or 20 shillings. Entered as second-class matter September 2, 1931 at the Post Office Albany, N. Y., under the Act of March 3, 1879. Volume [illegible] Number 5.



SIOUX
No. 662
Valve Face
Grinding
Machine
WET GRINDER

RYAN SCHOOL
of
AERONAUTICS
San Diego, California

Use the SIOUX
Valve Face Grinding Machine
WET GRINDER

The Ryan School of Aeronautics

like many of the airports have found that SIOUX equipment meets all their requirements for precision accuracy, speed and motor maintenance economy.

The SIOUX perfected, built-in wet-grinding feature creates a new high standard for valve face grinding efficiency . . . produces smoother, more finished jobs . . . makes precision work easier and faster . . . reduces wheel dressing to a minimum.

It wet grinds all valves, any angle, including 90 flat valves. Grinding head easily adjusted for large or small valves. It wet grinds valve tappets and rocker arms to original efficiency.

SIOUX No. 662 Valve Face Grinding Machine WET GRINDER comes complete with diamond dressers, micrometer gauge head, reamer sharpening and rocker arm grinding attachments, 4-quart coolant tank, 1/2 H.P. motor. Chucking capacity 1/4" to 5/8".

Write for full information

STANDARD THE WORLD OVER
SIOUX
ALBERTSON & CO., INC., SIOUX CITY, IOWA, U. S. A.

Announcing the
LENAPE "BRAVE"

95 H. P.—5 CYLINDER—BIG BROTHER OF THE FAMOUS LENAPE "PAPOOSE"

High in Power Output—Light in Weight, Smooth, Safe and Rugged in Performance

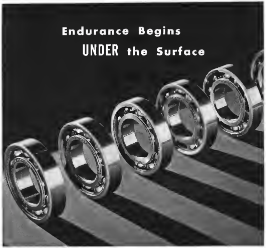
Lenape's newest engine offers all the advantages of radial design with the smallest frontal area of any American radial engine of equal power. The "Brave" accelerates fast, insuring full power on take off or in emergencies. Dual ignition gives increased safety in flight. Less weigh means more capacity for pay load, baggage or fuel. At 192 lbs. the "Brave" is the lightest engine in its power class. Fuel and oil consumption are low at all engine speeds and the simplicity of Lenape design makes service easy and upkeep low.

STUDY COMPETING ENGINES—THEN CHECK AND DOUBLE CHECK THE "BRAVE"

5 Cylinder – 95 H.P. – 192 lbs. dry weight – Bore 4¼" – Stroke 4" Rated engine speed 2200 r.p.m. – Diameter 34½" – Length 24"

WRITE for descriptive literature and full details. LENAPE AIRCRAFT & MOTORS, INC., P.O. Box No. 110, Matawan, New Jersey.

LENAPE AIRCRAFT & MOTORS, Inc.



● The extra strength and long life of New Departure Ball Bearings is not simply a matter of superfine steel and ultra-precision manufacture. At the very start, the principal parts are scientifically shaped by *forging* to assure the strongest possible formation and structure—*all the way through.*

The uniform dependability of New Departure Ball Bearings has been proved in important equipment in every airline in America. And for replacement—be sure—specify genuine New Departure.

New Departure, Division General Motors Sales Corporation, Bristol, Connecticut.

NEW DEPARTURE
THE *FORGED STEEL* BEARING

AVIATION

THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

Established 1916

MAY 1939 REGULAR EDITION

Contents for Vol. 38, No. 5

★

Louis F. Stoll
Vice-President

S. Paul Johnston
Editor

•

Leslie E. Neville
Managing Editor

Daniel Seyra
Associate Editor

Donald G. Fink
Radio Editor

Charles F. McReynolds
Pacific Coast

Paul Wooton
Chief of Washington Bureau

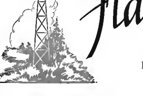
★

McGRAW-HILL PUBLISHING COMPANY, INC.
James H. McGraw, Founder and Honorary Chairman
Publication Office: 99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices: 330 West 42nd Street, New York, N. Y.
Chicago: 520 North Michigan Ave. San Francisco, 883 Mission St. Los Angeles, 2131 Hollis Ave.
Aldwych House, Aldwych, London, W. C. 2
Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

JAMES H. McGRAW, JR., President — HOWARD EHRLICH, Executive Vice President — MASON BRITTON, Vice-Chairman
B. R. PUTNAM, Treasurer — D. C. McGRAW, Secretary — J. E. BLACKBURN, JR., Circulation Manager

Published monthly, price 35c a copy. Subscription rates—United States, Canada and Latin American republics, $3.00 a year. All other countries, $5.00 a year or 20 shillings. Entered as second class matter, September 3, 1936, at the Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Cable address: McGrawhill, New York. Member of A.B.C. Copyright 1939 by McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York, N. Y. The following publications are combined with AVIATION: AERONAUTICAL ENGINEERING, AIRCRAFT JOURNAL and THE AVIATION NEWS. All rights to above names are reserved by the McGraw-Hill Publishing Company.

A McGRAW-HILL PUBLICATION



Flashes

Picked Up Along
Editorial Airways

» HELLZAPOPIN' AGAIN around aeronautical Washington Dopesters were still trying to figure out why C A A had not been declared exempt from re-organization when over the wires came news of Mr Noble's resignation and the announcement of Mr. Hinckley's elevation to the purple. Mr Noble is undoubtedly moving on to bigger and better things, and we wish him Godspeed. During his brief tenure of office he has been extremely amiable and cooperative in his relations with this magazine He has made an honest effort to grasp and to handle the complicated problems of the difficult situation into which he was somewhat unceremoniously thrust a year ago But when the score is finally added up, history must record him as the successful "big business" man rather than the savior of American aviation

» HINCKLEY'S INHERITANCE is no bed of roses. Criticism of C.A A. policies and programs has reached a level reminiscent of pre-Law (of '38) days. Rumors are rife of dissension within the Board itself, of difficulties (and even some embarrassment) between Board and Administrator. The docket is loaded with pending rate cases An elaborate experimental program for mass-training civilian pilots is under way And the retiring chairman put the C.A A on the spot with a considerable amount of talk about "built-in" safety for aircraft Altogether (and neglecting for the moment the Damoclean sword of reorganization now hanging overhead) "A Chairman's lot is not a happy one."

» BRIGHT SPOT in the picture, however, is the final Presidential appointment of Edward Warner to fill the vacancy on the Board It can be no news to AVIATION's readers that we have felt his presence on the C A A to be a desirable thing; that we were disappointed last year when he was passed over in the original appointments. Few people in this country have had the wealth or breadth of aviation experience, or possess the analytically judicial mind that Mr Warner will bring to bear on C.A A.'s pressing problems Latterly, as economic advisor to the Authority, he has carried a heavy load, has rendered invaluable assistance. As a member of the Authority, however, he will go a long way toward restoring that balance in aviation experience that we have long since felt to be missing in the original line-up

» THE SAD PART of the whole show is the fact that here we are, almost a year from the time that the new law went into effect, and things are still pretty much in a dither If there was any one thing that this aviation industry needed last year as the Law went into operation it was *stability*, a freedom from change and experiment Certainly no one can claim that anything of the sort has come out of it so far And the immediate future doesn't look much different. Perhaps if more fore-sight and less politics had been used about this time last year, things might have been different But there ain't no Santa Claus, either!

» THE PRIVATE PILOT is coming in for a lot of attention these days, now that there seems to be some possibility that there may be a whole lot more of him in the next few years, what with the 15,000 a year C A A. program, and all that. Everyone knows that the individual pilot has been less articulate in Washington than his more highly organized colleagues in air transport or in manufacturing He got a break, however, when C.A A appointed Grove Webster to look after his interests. Now, no less than three organizations have taken the field seeking large memberships among private flyers, hoping to become the "official voice" of non-scheduled aviation As far as we can see, their platforms are almost identical They seek simplification of C A R , fewer restrictions on private flying, elimination of duplication between State and Federal laws, continuation of C.A.A. training program, more airports, no discrimination against properly qualified and properly equipped private pilots on public airports. We can go along with all of them on all that, and we certainly favor any move that will lend encouragement to private flying everywhere, but we would feel a lot happier about the whole thing if the three outfits could get together on plans and

policies and really represent *all* the private pilots at once instead of running competitive membership drives, not entirely, we suspect, for the benefit of the P P The National Aeronautic Association and the Private Flyers Association seem to be fairly close together in the matter, which is all to the good The P F A has been carrying the ball for a long time under the able leadership of Bill Brinckerhoff, and if he and N A A's Bill Enyart can get together to settle their organizational differences of opinion they could make a strong team. Accord between either N A A. and P.F.A with the third group, an organization (as yet nameless, as far as we know) sponsored by a group of wealthy sportsmen pilots from Philadelphia, seems practically impossible at the moment. Perhaps we could wax a bit more enthusiastic about the latter effort if it didn't carry the earmarks of a circulation boosting scheme for a certain publication. It is regretable that the sponsoring group didn't size it up for what it seems, for nothing could be more certain that their own interests are solely to promote private flying without expectation of commercial gain for themselves

» READER'S DIGEST has suddenly developed a marked interest in private flying, also According to a release just received, "DeWitt Wallace (publisher of RD), and a pilot himself, decided that it would be a good thing to put a recognized authority and a plane at the disposal of any and all groups who are interested in flying" The idea seems to be to persuade the average citizen that the time is now ripe for him to fly The authority is Roger Q Williams, the plane, a Fairchild 24 The Colonel's assignment for the next couple of months is to cover New England making speeches to Kiwanians, Rotarians, Chambers of Commerce, and whatnot—also to take as many people as possible for first rides We don't know just what is behind this idea exactly, but it can't hurt aviation any to have such a widely read magazine as RD out promoting private flying The more speeches Col Williams can make, and the more first-flighters the Fairchild can take, the better.

» COMPLETE WASH-OUTS among new machines presented for evaluation at Wright Field recently have been high, have hampered the Air Corps' program for modernization and expansion. It seems probable that bad luck, rather than fundamental faults in the airplanes, was behind most of the accidents, but since in each case the only article submitted has been destroyed, how can it be proven? Which suggests a thought that is commonly accepted as good sense by other countries who are building up their air forces and which has already been hinted at by our own high command Why not require two or three identical samples of the prototypes to be submitted with each bid? It would be expensive, of course, but to the manufacturer it might prove a cheap form of insurance, and it would save a lot of time that is now being irrevocably lost with each accident Something to consider, especially in these times

» LAST MONTH we started a new series of engineering articles by Mr. George Titterton, the second of which appears in this issue Through oversight, we neglected to mention that these articles were based on work done by Mr Titterton in the preparation of a thesis for an A E Degree at New York University Herewith, our apologies to the author and to the University

"Moses is giving Maguire a few pointers on AVIATION'S Ten Commandments for Private Pilots." [*The finished job appears on page 19.—Ed*]

Side Slips

By
ROBERT OSBORN

» The Intrepid Aviator dropped in the office the other day for his routine check-up on the quality of our cigars, and along about the fifth cigar mentioned that he had gotten himself into a bit of trouble with the local Civil Aeronautics Authority Inspector.

It seems that things had been somewhat slow financially with the Intrepid Aviator lately so he had been filling in his spare time with a job delivering milk, the milk truck being one of those horse powered by a light four-cylinder airplane engine. However, the Inspector refused to credit

time on the milk route toward maintaining his pilot's license and was particularly sarcastic about one item in his log book listed as blind flying when he went to work right after a party and had to locate most of his customers entirely by instinct

» A news item mentions that a ten-passenger Lockheed Electra had just been delivered to the AEROPUT Air Lines of Jugoslavia. Judging entirely by the name of this company we should have thought they would be interested chiefly in the American type of "flivver" plane

» The lists of passengers carried in the Boeing Clipper in the preliminary "guest flights" around New York City filled several columns in the newspapers Many an old-time pilot was probably thinking how he would have been sitting pretty with one of those ships in the days when the barnstormers were still getting ten dollars per passenger for short hops.

» Army officials are reported to be still searching for the ideal plastic which could be used in the construction of the thousands of airplanes authorized by the new appropriations One official was quoted as saying he was looking for a material with which airplanes could be "poured out as easily as they could be with concrete" We can't tell him where to find such a plastic but we do know where there are a couple of airplanes that fly as if they had been poured out of concrete

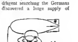
» One of the most remarkable illustrations of the amazing progress of airplane design in recent years is the fact that the gross weights of our larger aircraft are now given in tons rather than in pounds, as they were only a short time ago We didn't even bother with any intermediate stages of using "stone" or "hundred-weight"

However we notice that the trend of the gross weights of each individual design hasn't changed a bit since the Wright Brothers first flew While it was being tested on the west coast the newspapers referred to the big Pan-American boat as the "forty-ton Clipper," in the publicity attending its delivery to the east coast it had become the "forty-one-ton clipper" and now we read that the "forty-two-ton clipper" is making survey flights across the Atlantic If this trend in weights, size and speed is to continue at the same pace the U.E.C.A. will have to work up some new engineering units for us,—tons per square mile per hundred miles per hour,—and so on.

» Recently a private plane carrying a bridegroom-to-be and his best man across the country to a wedding in New York was forced down by weather and the group was delayed for several days. One thing led to another, it seems, and the wedding was finally called off

A friend of ours, known to be considerably hen pecked, is bewailing the fact that the airplane had not reached its present stage of development at the time of his marriage.

» A news dispatch states that after much diligent searching the Germans have discovered a large supply of



helium gas in a region near the Dutch border. Just for some good clean fun we think Mr Ickes should make application to Mr. Hitler for the export of some of this gas to the United States

» International Comment. Exports on foreign affairs have always stated that the present trouble in Europe and the Orient is the result of an inevitable struggle between the "have not" and "have" nations If this is the true cause of the difficulty it would seem that we aren't going to have to worry about Germany, Italy and Japan much longer

» We certainly were naive in assuming that a tropical island somewhere might provide us with peaceful sanctuary during the next war Recent events indicate we wouldn't be secure even if we owned a whole country with a well equipped standing army plus reservists

Pilots of the future and of the present should profit by the methods of Paul Wilcox, of Ryan, who is putting an STM through its paces above the clouds at a safe altitude of 10,000 ft. In his test work Pilot Wilcox climbs to 18,000 ft. before starting his routine of rolls, loops, dives, snap rolls, spins, and other acrobatics.

To the New Pilots of America:

The government of the United States is now making it possible for you to realize what must have been a longstanding ambition for many of you,—a chance to learn to fly. To many of you it will be just the beginning of a long career in aviation, one that will undoubtedly yield you much pleasure and profit, and one which can be of immeasurable benefit to the country.

Most of you look upon this new opportunity as a privilege,—and properly. But you must realize also that it entails considerable responsibility. There is more to it than just your own neck. The success or failure of the government's training program will depend in a large degree upon how seriously you look upon your part of it, and especially upon the elimination of all carelessness and negligence which might lead to unfortunate accidents. There is no doubt that public opinion will be aroused to oppose the continuation of the training program if any undue numbers of accidents occur.

And accidents need not occur. "Accidents don't happen—they are caused." Our designers and manufacturers have turned out the finest airplanes in the world for you to fly. The C.A.A. is taking every precaution through selection and inspection to insure that the equipment is airworthy and maintained in safe operating condition. The instructors with whom you work are trained and selected for their safe operating methods. Much, then, will depend on how you yourself behave, both during the dual instruction period and in the solo hours that follow.

No one can hope to give you a complete set of specific rules covering how you should act under every circumstance, but out of the combined experience of many others who have gone through the period of training on which you are now embarking, has come a set of general principles that you would do well to post in your cockpit. If you like, you can call it a modernized version of the Ten Commandments, for if you follow them religiously you will live to enjoy your earthly wings for many years.

These rules are simple, but if you follow them carefully you will very seldom get into trouble.

Good luck, and best wishes for many useful years in this interesting new job of yours.

Sincerely yours,
THE EDITORS OF AVIATION

I. DON'T SHOW OFF. Zooming over your girl's house, or turning to wave good-bye to her on a take-off is an easy way to terminate your romance suddenly.

II. KNOW YOUR LIMITATIONS. Don't try to perform the impossible with yourself or your ship. Don't be afraid to take a little extra time to check yourself out on a strange ship. Especially, find out when it spins, and why, so you won't be surprised some day.

III. DON'T TAKE THINGS FOR GRANTED. No one will resent it if you personally check your fuel or your controls before take-off. It is the mark of a good pilot.

IV. GET AWAY FROM HOME. You may know your own airport well enough, but making practice landings in strange airports is a good form of insurance. As soon as you are qualified, get all the cross-country you can. Learn to look for other wind indicators than a windsock.

V. WATCH YOUR WEATHER. Even the best of the air line pilots spend a lot of time looking at weather maps and flight conditions before every take-off. Stay on the ground when things look doubtful.

VI. STUDY THE REGULATIONS. Become familiar with the rules that have been drafted for your safety and obey the intent as well as the letter of the law. Most accidents can be traced to violations.

VII. CHOOSE YOUR FRIENDS, especially when it comes to listening to hangar flying stories. A lot of flying feats you hear from the old-timers never happened anyway, and besides, possibly someone may be pulling your leg.

VIII. THINK AHEAD. Take time out to consider all possible things that may happen to you and decide in advance just what you will do under all circumstances.

IX. SET A GOOD EXAMPLE. You may be young at this business, but remember there are those younger who look to you for guidance.

X. FLY HIGH—FLY FAST—KEEP YOUR NOSE DOWN ON TURNS!

By Melvin N. Gough
Senior Test Pilot
National Advisory Committee for Aeronautics

The TEST PILOT looks at AIRCRAFT SAFETY

Some thoughts on controllability and maneuverability from the pilot's point of view,—not necessarily conclusive, but certainly worthwhile as they stem from the author's experience as N.A.C.A. Senior Test Pilot. His job has involved many hours flying on many types and sizes of airplanes.*

If aviation is to come into its own—to be used by the masses for private operation and to occupy a position of public utility comparable with that of the automobile—safety must be given more prominence. It is hoped that this emphasis can be given to safety with a minimum handicap to performance but, regardless of the cost in that respect, if aircraft are to be made safer for the average person, improvements in design must be effected which will *reduce* the regulation and education now imposed on the operator and, by the simplification of duties and the improvement of working conditions, eliminate the physical and mental fatigue with which their operation is now associated. There is no doubt that many such improvements can be made.

The Bureau of Air Commerce and its successor, the Civil Aeronautics Authority, have done all in their power to set minimum standards of performance and flying qualities that are reasonably necessary to insure a fair degree of safety. They recognize the possible reward in safety attached to exceeding the standards so set. But an attempt is made to be as tolerant as possible. What happens, however, is that the desire for greater load-carrying capabilities or increased performance on the high-speed end of the flying range causes an endless cry from designers for further tolerance in these standards. Very seldom are the applications of new highlift devices used to increase safety by further reduction of minimum speed. The minimum is kept as it was and the top speed is increased. And equally seldom, if ever, is more thought given to stability and control characteristics than just enough to meet the minimum requirements set.

Surely progress in aviation can be made other than at the expense of safety. Heretofore, it has not been entirely clear as to how that result could be accomplished, and it still is not clear. Designers have surprisingly little information on which to base their designs. Accurate estimates of performance can be made, but flight characteristics are more a matter of chance. Practically all existing data on flight characteristics, and by that is meant the behavior of an airplane under deflected controls or external disturbances, are of a qualitative nature. There is need for more specific knowledge. It remained for E. P. Warner to suggest the evaluation of flying qualities on an exact numerical basis in hope that by so doing a uniformity of opinion on the part of the operators and pilots as to what constitutes good characteristics and safe flight operations might be obtained. Then might such characteristics be designed for and their realization determined.

The National Advisory Committee for Aeronautics at its Langley Field laboratories made a study of Mr. Warner's proposal and prepared a general program of measurable flying qualities and of the tests by which they could be studied. Consideration was given to the definition of the flying qualities in terms of factors known to be susceptible of measurement by existing N. A. C. A. instruments. Consideration was also given to the possibility of making the measurements with standard aircraft indicating instruments.

Largely under the direction of Fred E. Weick, formerly of the Laboratory staff, qualitative studies of specific control and stability problems had been made for many years and, in many cases, specific measurement was made from which quantitative data were obtained and an attempt made to evaluate desirable and undesirable characteristics in specific conditions. But for the first time an attempt was to be made to measure the manner in which these many characteristics grouped together asserted themselves in a complete airplane design. The available instruments, all of which could be synchronized with time and personal observation, measured air speed, control disposition, and airplane motion and attitude, as defined by velocity and acceleration along and about the three major space and airplane axes. Already, tests have been made on seven airplanes ranging in size from 4,000 to 70,000 pounds and having from one to four motors. Although the quantitative data on these specific airplanes are considered confidential and are not yet available for publication, the exactness and comparable nature of the test procedure has resulted in additional piloting experience and, it is believed, allows a more definite expression that has heretofore been possible regarding many of the known desirable and undesirable stability and control characteristics of modern airplanes. The unusual opportunity has existed for close cooperation between engineers and pilots to obtain a mutual understanding of exactly what does take place both qualitatively and quantitatively.

In a comparison of the basic safety of air transportation with the safety of other means of transportation with regard to stability and control, one should pick out the strong points of the other forms of transportation. Surface vessels and four-wheel vehicles have a very large inherent capacity to remain right-side up. Under normal conditions and in bad weather and fogs, the attention of the operator is not required in keeping them from overturning. In addition, all types, excepting possibly submarines which are surely not recognized as a particularly safe means of transportation, are exceedingly resistant to vertical displacement.

As regards piloting errors, it would seem that the first accident which occurred to a new type airplane might be found to have occurred due to a so-called error in judgment on the part of the pilot and improper operation of the airplane. But when the second or third accident occurs, this common failing of the human being can no longer be charged with the accident. It becomes a designer's error. One of the first questions asked in an investigation of accidents in subways, railroads, or steam vessels, is: "What happened to the safety devices?", or "What safety devices could be applied to keep a repetition from occurring?". The application of a similar thought to aviation is the intention of the C. A. A. in their quest for built-in safety. The important point is how can accidents be prevented and not who is at fault.

Lateral Control and Stability

One of the most important factors governing safety is good control. It is reasonable to expect that an airplane shall be easy and simple to control under all conditions of flight. Control and stability, major factors affecting maneuverability, are closely related. They are no more easily separated in discussion than in flight. An aileron control system which was perfectly normal when used on a wing with no dihedral angle actually produced, first, no roll and then a reversal in the the direction of the roll due to accompanying adverse aileron yaw when the dihedral was increased in the interest of stability. Owing to large variations in acceptable stability, it is hardly to be expected that any one best combination of stability and control will be found. Pilots will, in general, take all the control they can get. Is it not possible that in many respects they can, and do, get entirely too much?

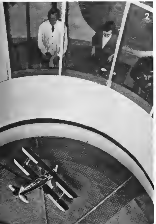
Controls are judged by the force required to operate them and the response produced. Individual controls which are light, free of friction, have small inertia, require an increased force application with deflection and forward speed, and, in addition, produce, with no lag or delay, a response that varies smoothly and linearly with displacement have been found to be both pleasant to operate and desirable. Such controls instill confidence. There is a certain logic in their operation. Friction and irreversibility are responsible for the lack of self-centering and thus, in effect, reduce stability. There should also be a certain uniformity in the relative variation of the effort required on the part of the pilot to operate the various controls. For instance, controls of the conventional type require about the same apparent effort for their operation if the forces to operate them in normal flight are approximately in the ratio of 1:3:10 for the ailerons, elevator, and rudder, respectively.

Powerful lateral control is desirable for maneuverability. There is an increasingly apparent need for ailerons with greater response in roll than any that now exist, accompanied by no yaw. It is inherent in present types of ailerons that response decreases with decrease in speed. There never seems to be sufficient control at low speed and high angles while there is almost always a complete loss of control beyond maximum lift. Even if the controls were vastly improved, however, experience has shown them unsatisfactory to cope with the situation if violent instability in roll exists.

Reduction in lateral control at high speed due to limited deflection caused by cable stretch has also been found objectionable.

(*Turn to page 80*)

** A paper prepared for the aeronautical session of the Tenth Annual Convention of the Greater New York Safety Council, March 30, 1939.*



RESEARCH WINS WARS!

Victory or defeat in the coming struggle for air supremacy on international trade routes or in military campaigns is now being metered out in aeronautical laboratories.

SOMEONE said once that Britain's wars were decided not on the field of battle but on the playing fields of Eaton. With equal certainty we can say that wars between the great air powers in the future are now being decided in the wind tunnels, towing basins and engine laboratories of the aeronautical research centers of the world. The evidence is already in sight. It can be no mere coincidence that those countries who are now making the strongest bid for national supremacy through the threatened application of unrestricted use of air power are the ones that have undertaken the most intensive and the most extensive developments of their aeronautical research facilities in the past five years.

In the course of two recent trips abroad AVIATION'S editor has had opportunity to visit many of the great aeronautical research centers in Europe, including Britain's National Physical Laboratory at Teddington and the Royal Aeronautical Establishment at Farnborough; Germany's great research center at Adlershof, the French experimental arsenal at Villacoublay, and the aeronautical city of Guidonia near Rome. To such first-hand evidence has been added the experiences of other observers and recourse to recent progress reports from abroad. Out of it all emerges a very impressive composite picture.

The Deutsche Versuchsanstalt fur Luftfahrt at Adlershof (Berlin) has for many years conducted an efficient large-scale research program. An excellent summary of the range of the experimental work undertaken by the DVL was presented by its director, Dr. F. Seewald, before the Royal Aeronautical Society in London last November. The equipment at Adlershof is on a par with that of our own N.A.C.A. at Langley Field, except that no full-scale wind tunnel equipment had been installed up to this year. Reports indicate, however, that a full-scale tunnel project is probably under way. In the last two years additional equipment has been added to the Adlershof installation including a very high speed wind tunnel (reported to have 17,000 hp. connected, to provide a maximum air speed of just over 900 ft. per second in a test section approximately 10 in. in diameter), a large laboratory for static and vibration tests on airplane structures, and high altitude test equipment for engines over 1,000 hp. Changes have also been reported in the vertical spinning tunnel so that it may now operate at pressures up to three atmospheres.

But equipment is not everything. It takes trained men to staff a worthwhile aeronautical research laboratory. It is known that the personnel of the DVL at Adlershof outnumbers the Langley Field group by four to one, and the DVL is only one of five major research stations now operating in Germany! In fact, the total German research organization is estimated to be between six and eight times the size of that of the United States. It is known also that certain large universities in Germany are conducting considerable experimental work in aircraft and engines and are at the same time turning out trained technicians for aeronautical research in large numbers.

Italy is close on the heels of her axis partner in quality of research if not in magnitude. The research city of Guidonia with its high speed towing tank, its battery of quadruple wind tunnels, and its new supersonic tunnel makes an impressive showing to the American visitor. It is no accident that Italy has captured a large share of the world's speed, altitude and endurance records, or that she possesses airplanes and engines whose efficiency ranks close to the top in Europe today. The answer may be found within the walls of Guidonia.

Although Japan will probably never be a leader in research, certain of her scientific men have made notable contributions in the field of aerodynamics and it is known that her research activities are being expanded materially. But there is little doubt that her aircraft will continue to improve at a rapid rate as long as she is in a position to profit by the political partnership with Germany and Italy by drawing on the research facilities at Adlershof and at Guidonia.

About Russia we know little enough—but there is ample evidence that extensive research programs are continually

(*Turn to page 94*)

(1) Outside one of the larger wind tunnels of the DVL at Adlershof. (European)

(2) Testing a model in the vertical spinning tunnel at Adlershof. This tunnel is now arranged to operate at three atmospheres maximum pressure. (European)

(3) Experimental section of an open throat tunnel of the DVL. Note that balance and model are on a travelling platform.

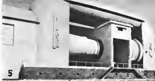
(4) Aerodynamic research at the Tsiolkovsky dirigible center in Moscow. (Sovfoto)

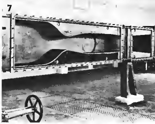
(5) The ten foot double return tunnel at Guidonia. Test section may be completely closed by a rolling door.

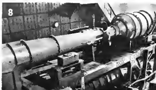
(6) Battery of four identical six foot tunnels at Guidonia.

(7) Test section of Italy's supersonic tunnel. Air speeds up to 2.7 times the speed of sound may be attained.

(8) Even the Japanese are constantly improving their research. (International)

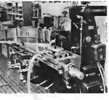






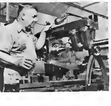
Machine Shop at Vultee

Unit assemblies are brought together at this assembly station in the Vultee plant



A swinging fixture for drilling and reaming taper holes to a common center and for milling bracket clearance on the flange ends in gun ring mount set-up.

Guide V's on Vultee landing gear oleo-axle part are milled to micrometer dimensions with special cutters.



To liquidate the heavy machine tool equipment investment in an aircraft factory, the machines must be used nearly 24 hours a day. Here are a number of ingenious set-ups and attachments devised by Vultee engineers to make a single machine do many different jobs.

By Don I. Carroll

In aircraft machine work, there are two major differences from more conventional machine work. The first is the almost universal use of light alloys of aluminum and magnesium The second is the relatively greater bulk of the parts being machined The materials machined consist largely of castings and forgings, although a department has been developed for the cutting or profiling of sheet materials, this will be discussed in more detail later. We also have our share of steel and bronze machine work, especially in connection with heavily stressed parts such as the landing gear and actuating systems Furthermore, a rather large percentage of our work is done on milling machines rather than on lathes, therefore, some of our more difficult problems have been in connection with mill set-ups

One of the first things we learned when we undertook machine production of a wide variety of aircraft parts, was that a relatively few machines must be made available for as many jobs as possible. This is essential from the standpoint of economics, because an airplane factory cannot bear up under an unlimited overhead Machine tools represent a relatively heavy investment and they must be kept working 24 hours a day if feasible, to retire the investment as quickly as possible Therefore, we have developed a great many ingenious fixtures and set-ups to accomplish the triple purpose of producing the best possible work doing it efficiently, and keeping all of our machines busy at all times.

Our machine work is divided generally into two classes, structural and operative. The structural work usually involves milling and drilling operations primarily The operative work concerns actuating systems, control systems, etc The latter class of work is rather conventional, involving gears, shafts, brackets, etc, and does not cause nearly as much trouble as the structural work. This is due partially to the fact that the structural parts are usually larger and more difficult to handle, and partially because some of the structural tolerances are rigid and unusual, as in the case of holes drilled in the gunner's seat back casting, which is a large ring segment with a diameter of approximately 30 in It is necessary to drill 12 holes in this segment, at various points along its arc, and all of them must be drilled to a common center These holes must also be reamed to close tolerances To do this job we have developed a swinging fixture which is attached to the table of a Cincinnati horizontal miller The fixture is indexed for location of the holes and the drilling and reaming is done with tools mounted on the mill shaft We also use another mill set-up for this same part, in order to drill the large holes in the bracket at each end of the casting These holes accommodate the support tubes for the machine gunner's adjustable seat and must be held to close tolerances on location and diameter.

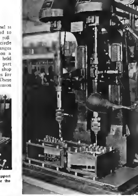
A similar problem is met in drilling and milling the gun ring mount. This is a ring segment, slightly larger than the gunner's seat ring, and is quite interesting inasmuch as it comes into the plant as a straight extruded channel of approximately I-beam cross section This channel is cut to length and is then rolled to form a proper arc in the Vultee rolling machine. It is then given a circle diameter cut on the outside flanges by means of a special set-up on a profiling machine. This work is held to a tolerance of 0.002 in The part is then delivered to the machine shop and there we drill 12 taper holes for mounting roller supports These holes must be drilled to a common center and are reamed to an accurate taper For this work we use a swinging fixture on a Cincinnati horizontal miller, very similar to the set-up used for drilling the machine-gunner's seat ring The inside flanges of the ring are then milled at each end in another mill set-up in order to provide for bracket clearance at the points of attachment to the gunner's seat ring

(Turn to page 84)

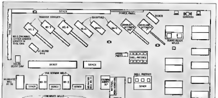
The first of two articles prepared by Mr. Don I. Carroll, Plant Manager, Vultee Aircraft Division Aviation Manufacturing Corporation with C. F. McReynolds and published in co-operation with American Machinist

Set up for boring the main axle support holes in the magnesium casting for the Vultee control pedestal.

Boring, reaming and turning a hub for a felt grease retainer in part of the oleo cylinder assembly.



The cluster casting for the main wing beam center section is drilled symmetrically in a precision jig and later reamed to close tolerances.



4,000 sq. ft. of a total plant floor area of 200,000 sq. ft. is occupied by the Vultee machine shop. Many fixtures and set-ups keep a relatively few machines in continuous operation

Solar method of modelling clay form from which a plaster pattern is cast to obtain pressing dies. Fig 8

Stacks and Rings

The design and installation of exhaust manifolds and their accessories

The second of three articles.

Part II—Expansion Joints

By George F. Titterton

Executive Engineer, Grumman Aircraft Engineering Corp.

An exhaust system goes through many rapid changes in temperature within a range from below 0° F to as high as 1500° F It is necessary in the design to provide for the expansion and contraction of the individual parts as well as the whole system Satisfactory results are obtained if an expansion joint is placed in the main collector ring between each cylinder in a single-row engine, or between each pair of cylinders in a twin-row engine

Expansion joints must be relatively gas tight but free enough to permit easy sliding when the exhaust is hot. Three types of joints are shown in Figs 5, 6 and 7 (pages 86 and 88) A clearance of 0.010 inch is maintained between the expansion sleeve and the main exhaust collector ring This clearance diminishes when the exhaust is hot and relatively little gas escapes

To permit proper servicing of the engine, easy replacement of sections of the exhaust collector ring, and freedom from structural failure the following points should be taken into consideration in the design of an exhaust collector

1 Removal—It is frequently necessary to replace one section of an exhaust collector, or to pull one cylinder of an engine Considerable time and labor can be saved if the construction of the collector permits the removal of one section The type of expansion sleeve shown in Figs 6 and 7 permits such removal. If in addition the exhaust elbow incorporates a clamp type joint such as shown in the accompanying photographs the removal of one section is further simplified.

2. Interchangeability—The manufacture of all parts of an exhaust collector should be jigged to insure easy fitting of replacement parts Tubular parts can be bent by specialists in tube bending to exacting dimensions Parts fabricated from sheet can be stamped out or pressed to the desired shape One method of obtaining an accurate pressing die is shown in Fig 8 For welding parts a very substantial jig is necessary to prevent distortion of the work In this connection it is advisable for the welding jig to duplicate the exhaust port locations on the engine so that the mounting flanges can be welded in place with the assurance it will not be necessary to strain them when installing the collector on the engine

3 Expansion—The need for and method of providing general expansion joints is explained under the subheading "Expansion" above. Examination of Figs 1 and 3 of the previous article will show, however, that no expansion joint is incorporated between the last 2 cylinders adjacent to the outlet In this location it is advisable to have two exhaust elbows secure the last section of collector ring Since no flexibility is provided under severe service conditions of expansion and vibration there will be a tendency for cracks to occur at the welded intersection of the elbows and ring It is possible to overcome this weakness by welding reinforcing gussets across the critical areas An alternative method is to put an expansion joint between the last two cylinders and install an auxiliary brace to help support the last section of the collector ring A clamp brace of this type can be seen in Fig 9

4 Vibration—Aircraft engines usually have one or more critical vibration periods in the normal operating range If exhaust systems have long overhangs, or are improperly supported, or are carrying welding strains, the vibration of the engine will soon cause cracking The use of split type clamps as shown in Fig 9, referred to in the previous paragraph, is an excellent way to brace the collector against vibration The inboard end of the clamps should be secured to the engine mounting bolts or other points that will move with the engine as it rotates slightly in its rubber mounting

Weight

In the design of successful aircraft it is essential that the weight of all component parts and accessories be kept as low as possible commensurate with satisfactory operation Exhaust

(*Turn to page 86*)

Based on a thesis submitted to the College of Engineering New York University New York

Courtesy Solar Aircraft Co

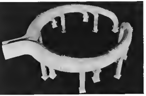


Fig. 10. Exhaust manifold for Wright R2600 engine. Note the gradually increasing diameter of the main collector

Courtesy Grumman Aircraft Eng Corp

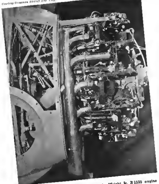


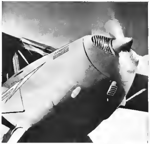
Fig 9. Exhaust manifold for P & W Twin Wright Jr. R1535 engine Note lead for carburetor hot spot heater. Note also the clamp for supporting last section of collector ring.

Courtesy Solar Aircraft Co.

Fig 11. Exhaust manifold for P & W R 1830 engine. Note carburetor hot spot provision and shape of exhaust extensions

STINSON 105

A three-place Cabin Ship with 75-hp. Continental Engine for $2995



Everyone has realized the need for an inexpensive airplane to be used as the next step above the present light plane class and Stinson has set about to satisfy this demand. The result is the Stinson 105 which, powered by the 75 hp. Continental engine, sells for $2995 Fuel consumption is 4.5 gallons per hr or about 25 miles to the gallon. Cruising speed is given as 105 m.p.h. high speed 115 m.p.h.

Model 105 follows regular Stinson practice in that it is a high wing, semi-cantilever monoplane Spruce spars, pressed metal ribs, steel drag trusses and tie rods and metal struts are used in the structure A metal covered leading edge and fabric covering are used. Ailerons are built up of a steel torque tube and metal ribs Surfaces are statically and aerodynamically balanced All hinges are fitted with ball bearings N.A.C.A. slotted type trailing edge flaps extend from ailerons to the fuselage and are adjustable to three positions They may be used for takeoff as well as landing, and are operated by a lever between the pilot and copilot seats Built-in slots extend over 50 per cent of the aileron span to increase lateral control at high angles of attack

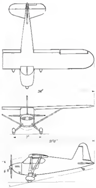
The cantilever stabilizer is built up of spruce beams and ribs and covered with phenolic glued plywood Elevators are continuous and built of metal ribs attached to a steel torque tube and are covered with fabric. One elevator has a tab Needle bearings are used in the hinges.

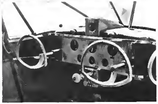
Steel tube spars and ribs are used in the construction of the integral, cantilever fin The rudder is of steel tube construction with fabric covering It is mounted on ball bearing hinges Its trimmer tab is adjustable on the ground

A welded steel tube truss type fuselage structure covered with fabric, is used The removable engine mounting is attached by rubber vibration dampers The stainless steel firewall is insulated against heat and noise on the rear face Doors are provided in each side of the fuselage

Within the cabin one finds a modernistic decorative effect Adjustable pilots' seats and the third seat in the rear are trimmed with tobacco brown Boucle fabrics Backs and sides of pilots' seats are finished in chro-

(Turn to page 94)





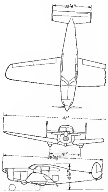
Weights

Weight Empty		925 lb.
18 Gallons Gasoline	108 lb	
1 " Oil	8 lb.	
3 Persons	510 lb.	
Baggage	24 lb.	
		650 lb
Gross Weight		1575 lb.
Wing Loading	10 2 lb. per sq. ft	
Power Loading	21 "	h p.

Performance

Maximum Speed	115 m.p.h
Cruising Speed.	105 m.p.h
	(@ 75% Rated Power)
Rate of Climb (Sea Level) Fully Loaded	430 f.p.m
Service Ceiling Fully Loaded	12,500 ft
Landing Run	100 ft
Range	470 miles

Fuel consumption—25 miles per gallon



The Unitwin VEGA

A new approach to the private transport problem

By Mac Short

President Vega Airplane Company

Flight testing is scheduled to start at about the time this article appears in print (or very soon thereafter) on a rather unique airplane which represents an entirely new approach to the private transport market. The Unitwin Vega is a multi-engined airplane with general appearance and handling characteristics of a single engined plane Chief features, such as the level landing gear and the linkage of two Menasco engines in a power unit to drive a single propeller, have been given full scale tests The engine feature has received many hundreds of hours of ground and flight testing and is now well past the experimental stage

There are physical limitations on scaling down conventional multi-engine equipment to a size suitable for the private field. And few private pilots have the time and money to acquire the skill and experience required to operate conventional multi engined equipment Therefore, we decided to develop an entirely new type plane, combining the reliability of the present airline transport, with the simplified control and flight characteristics of our single engine private flying equipment. This was no easy problem, but the key for its solution was provided by Mr. Hall Hibbard, chief engineer of the Lockheed Aircraft Corp who suggested gearing two engines to a single propeller through free-wheeling clutch units. The name Unitwin, to designate such a powerplant, was suggested by Mr Robert E Gross president of Lockheed Aircraft Corp The actual engine unit was developed by the Menasco Manufacturing Company, around two of their C6S-4 engines These engines are six cylinder in line air cooled inverted engines developing 290 hp each at take-off to give a total powerplant output for the two engines of 580 hp at take-off

Original test work at the Menasco plant was performed on two Wright Gipsy engines, which served to prove the principle of operation thoroughly satisfactory Part of this program was accomplished with the Unitwin unit mounted in a modified Lockheed Altair plane. This plane has been taken off under full load with only one engine running from a standing start, and has then been climbed to 12 000 ft on the one engine.

While the engine development program was in progress Vega engineers conducted extensive mathematical analyses and wind tunnel testing, in comparing the proposed Unitwin powered Vega with a conventional layout using two engines mounted in wing nacelles The results of this design study were in every case favorable to design A, with Unitwin powerplant, as compared with design B, with conventional engine installations On an analysis of aerodynamic efficiency we got the following results

Mac Short
who presents his views on a novel design

1. Airplane drag.

Suppose the two airplanes of Types A and B have the same fuselage cross-sectional area and the same wing chords The differences in drag will then be due to (a) nacelle drag, (b) slipstream drag, and (c) cooling drag The effect of the slipstream is to add from 6 to 10 per cent to the drag of a body lying in the slipstream. Cooling requires from 6 to 12 per cent of the total power output, depending on the number of cooling systems, and their refinement A 10-ft propeller is assumed for the Unitwin, and two 9-ft propellers for the conventional arrangement, with 50-ft. wing span in both cases

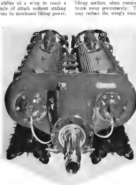
Now if D equals drag of the airplane without nacelles, slipstream, or cooling and 5D equals drag of the wing, or approximately 01D per foot of span 4D equals the drag of fuselage and 1D equals the drag of tail, then we get the following.

	Type A Unitwin		Type B Conventional two-engine	
Fuselage drag	1 08 x 4D equals	432D		400D
Wing in slipstream	10 x 1 08 x 01D equals	108D	18 x 1 08 x 01D	194D
Wing out of slipstream	40 x 01D equals	400D	32 x 01D equals	320D
Nacelles	None		2 x 04D equals	080D
Cooling		060D		090D
Tail drag		100D		100D
Total drag		1 100D		1 184D

Thus we find Type A (Unitwin powered) to show about 8 per cent less drag than type B.

2. Wing lift.

The ability of a wing to reach a high angle of attack without stalling determines its maximum lifting power, and hence the minimum speed at which an airplane can fly and land The addition of nacelles to a wing changes the airfoil shape, making that portion of the wing a relatively poor lifting surface, often causing flow to break away prematurely This effect may reduce the wing's maximum lift by 10-15 per cent, requiring additional wing area for type B to assure the same minimum speed as for type A



Single engine control.

The effect of engine failure with a conventional two-engine airplane is to cause eccentric thrust and lift due to the live engine, and eccentric drag due to the dead engine These effects cause the airplane to bank and yaw slightly so that rudder and aileron displacement are necessary to keep the plane on a straight course These control displacements introduce further eccentric drag items.

As the size of a twin engine design is diminished the propellers become relatively larger with respect to the wing span, the rolling and yawing moments become relatively more adverse, and greater care must be taken to insure proper single engine control The scale effect on single-engine control may readily be demonstrated as follows, by comparing our previous Types A and B, with a larger plane, the Douglas DC-3

Type A airplane (Unitwin)

Span 45 ft
Engine—one 600 h p
Propeller—one 10 ft diameter
Distance from Center Line to Thrust Lane—0.

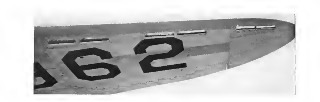
Type B airplane (Convention twin engine)

Span 50 ft
Engines—two 300 h.p each
Propellers—two 9 ft diameter, each
2x9 ft. plus 5 ft. across fuselage equals 23 ft
Distance from Center Line to Thrust Line Equals 11½ ft. or 28 per cent of semi-span

Type C airplane (Douglas DC-3)

Span 95 ft.
Engines—two 1000 h.p each
Propellers—two 12 ft. diameter each
2x12 plus 8 ft. across fuselage equals 32 ft
Distance from Center Line to Thrust Line equals 16 ft. or but 21 per cent of semi-span

(*Turn to page 90*)



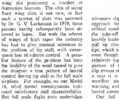
No-drag Wing Slots

By Hall L. Hibbard

Vice-President and Chief Engineer, Lockheed Aircraft Corp

All Lockheed 14 airplanes, including those already in service, are being equipped with a novel type wing slot possessing a number of distinctive features The idea of using fixed wing slots is not new, in fact such a system of slots was patented by Dr G V Lachmann in 1919, these patents having subsequently been allowed to lapse But with the advent of wings of high taper the industry has had to give unusual attention to the problem of tip stall, with consequent loss of aileron control A peculiar feature of the problem has been the inability of the wind tunnel to give the designer a true picture of lateral control during tip stall in the full scale airplane. For example, on our Model 14, wind tunnel investigations indicated satisfactory stall characteristics But full scale flight tests undertaken to investigate the stall condition disclosed an unsatisfactory tendency to tip stall which it was advisable to correct What the wind tunnel has not been able to do is show us the effect of slip stream on tip stall And it is possible that designers have given primary attention to stall conditions with minimum slip stream affect, as in the approach for a landing, when the critical condition may actually be on the take-off Taking off with a heavily loaded airplane it is possible to pull up sharply enough to stall the tips, which are outside the slip stream, even though the plane is moving at relatively high speed. But the center portion of the wing, swept by the slip stream remains unstalled. In such a case it is possible for the stall to manifest itself without preliminary warning, and first through the loss of lateral control

Wool tufts, show air flow over wing with slots.



Our full scale flight testing has shown the new Lockheed wing slots entirely effective in eliminating this tip stall condition Through use of the slots aileron control is maintained beyond the stall condition, so that full lateral control is available under all flight conditions Furthermore, since stalling with tip slots, occurs first over the center portion of the wing, the resultant buffeting of the tail by the burbling air gives the pilot ample warning of an approaching stall

The Lockheed slots follow the best available information on fixed slot design, thus eliminating the complexities of moving parts But we have departed from the leading edge slot arrangement in order to permit use of conventional de-icer equipment The Lockheed slots are located directly back of the de-icer boot Span-wise they extend across approximately 60 per cent of the aileron span. The Lockheed slots are not continuous, but are installed in five increments on each wing This prevents changing the structure of the wing and the arrangement proved fully as effective as a continuous slot in full scale flight testing Under normal low angle of attack, high speed conditions, as at cruising, there is practically no flow of air through the slots and no appreciable reduction in cruising speed of the airplane. At top speed we were able to measure a speed reduction of about 2 m.p.h. due to the use of the slots

It will be appreciated that the Lockheed slots have been designed primarily for their value to improved aileron control at or near stalling speeds. There is no appreciable difference in stalling speed of the plane, angle of stall, or lift on take-off, with the Lockheed slots But there is the fullest lateral control at all speeds and under all conditions

The Lockheed wing slots have been fully approved by the CAA. A plane, Lockheed No 1401, recently toured the United States and Canada to demonstrate the new slot system to pilots, airline executives, etc. Reactions have been uniformly good

The Lockheed slots are not patented and this system may be used by any manufacturer interested in adopting it

The Birdmen's Perch

Right now we're wondering if everybody has written for his or her *free* copy of the 5th edition of the Gulf Aviation Atlas It's a swell big book packed with flying info, maps, charts, pictures, and air history The supply is getting low, so you better send for yours right away Write—a penny post card will do—to

MAJOR AL WILLIAMS, alias "Tattered Wing Tips," Mgr Gulf Aviation Products Gulf Bldg, Pittsburgh Pa

THE M-M-MYSTERY SHIP

Here's one that was sent us by Ben Martin of Ladysmith, Wis Thank'ee, Ben!

An international spy (Platinum Blonde

type No 1) recently unearthed the following data on a new bomber built in a secret factory in one of the Balkan States

"Model X" has a motor 9' long The fuselage is equal to the sum of the length of the motor and ½ the fuselage The length of the tail is the motor plus ½ the tail The whole plane, naturally, is equal to the sum of the motor, tail, and fuselage"

In the general's other pocket she found the following

"To find the wingspread, multiply the square root of the square root of the length of the plane by the length of the fuselage and add the length of the motor And the speed may be represented by the sum of those two specifications which, plus one, are equal to another of the specifications plus one squared"

Being a smart girl—although a blonde—she figured out the answers and decided getting the blueprints would not be worth the effort What do you think? Send in your figures to T W T for checking Official version by return mail

DOING IT THE HARD WAY

There are two ways to do everything . . . the easy . . . and the hard

Take refining our Gulfpride Oil for instance We could be satisfied with ordinary methods that remove most of the impurities But instead we use an *extra*, added refining step—the famous Alchlor process This remarkable process—exclusive with Gulf—digs down so deep into the 100% Pure Pennsylvania that it removes still more dirt, sludge, and carbon formers It may be the hard way but, when you think what they can do to a motor . . . boys, it's worth it!

THIS MONTH'S WHOPPER

Dear Major

Of course we all know about the marvelous qualities of Gulf Aviation Gas when used as a mouthwash But I claim to be the first to discover that it actually contains vitamins!

Out at our local flying field we have a mascot named Oscar Oscar is a mosquito Mind, he isn't one of those pigmy species that live in Florida, Louisiana, and New

Jersey And which weigh only about five pounds apiece Oscar is a real *California* mosquito

We first found Oscar in one of the hangars drinking out of a can of kerosene He wasn't very husky then but after we adopted him and he got his meals of Gulf Aviation Gas regularly, he really began to *GROW!* (Everything grows in California)

We sure were proud of Oscar But soon he got so big his meals presented a serious financial problem We tried curtailing them but he began attacking the planes and drinking right out of the tanks At last the boys decided we would have to stop using Gulf Aviation Gas or get rid of Oscar When the coin flipping was over (it went to 11,111,112 out of 22,222,222)

we set a trap for the poor beastie What we used was a case and a half of dynamite saturated with Gulf Aviation Gas We attached a long fuse lit it, and hid to await developments

Oscar must have suspected something for he kept off a good distance for a while But finally the aroma of that G A G was too much for him In he charged and gobbled down that dynamite before you could say "contact!" And no sooner had he swallowed it than it exploded with a roar that could be heard in Zanzibar

Poor Oscar! I'm telling you, Major, we had a mighty sick mosquito on our hands for a couple of weeks

Norman McEwen

The Background of the BARKLEY-GROW WING

By John T. Whitaker
Barkley Grow Aircraft Corp

THE basic problem that faces all aircraft designers is to develop a wing which will, at the same time create lift and carry the loads imposed upon it. Most designs embody the simple principle of a spar or beam to carry the main load, surrounded by suitable structure to develop the airfoil shape Although the spar may sometimes be split up into two or more elements, the basic principle remains the same

Recently, in order to avoid the concentration of forces that normally enter the beam-spar design (Sketch *A*) attempts have been made to handle the distributed loads as they occur over the entire wing structure by making the wing itself a composite spar or beam (Sketch *B*) The usage of boxspars, *D* or cylindrical shaped monospars, stressed skin wings with internal lattices and stiffeners and other arrangements, have all been directed toward this end

Although the cellular form of construction cannot be said to be the idea of any one man, a new form for the application of the principle did occur to Archibald F Barkley some ten years ago as he observed the progress of the construction of the first all-metal dirigible, the ZMC-1 at Grosse Isle, Detroit Followed a period of design and development during which many wing models were made and tested to destruction Out of it developed a design that showed considerable promise of load carrying capacity without distortion at a reasonable weight per sq ft By 1935 work had progressed sufficiently so that a group of Detroit business men underwrote the manufacture and test of a complete wing Results were so satisfactory that a complete airplane design was inaugurated which has resulted in the eight to ten place Barkley-Grow twin-engine transport, the Model THP-1 (AVIATION, February 1939)

A slight accident that occurred during the static testings of one of the wings for the transport shows something of the ability of the wing design to "take it" The panel under test was 194 in long with a 96 in chord and 14 9 in thickness at the root It was tapered in plan and in section and had a total area of 92 sq ft A slippage in the test rig allowed a full load of 17,000 lb to be applied suddenly and unexpectedly to the panel This loading caused a final deflection of 15 in. at the wing tip When the test load was finally removed, the panel recovered to 2⅝ in of its normal position at the unsupported tip.

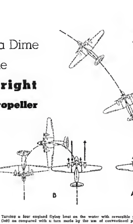
On first sight the structure of the Barkley-Grow wing seems complicated from a production point of view, but studies and actual shop experience have indicated that methods can be developed to produce structures of this type economically and efficiently

Additional tests are going forward at the present time on the application of wing design to military machines Upon completion of these tests it is hoped that we will be in a position to give to the readers of AVIATION a great many more technical details of the design and production of this wing than has been possible at this time

SKETCH "A"

SKETCH "B"

Turning on a Dime With the Curtiss-Wright Reversible Propeller



Turning a four engined flying boat on the water with reversible pitch propellers (left) as compared with a turn made by the use of conventional propellers (right)

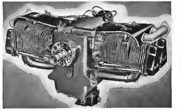
A NEW MILESTONE in propeller design has been passed with the introduction of the Curtiss-Wright reversible pitch propeller recently announced by Robert L. Earle, general manager of the Curtiss Propeller Division at Clifton, N. J. Work on this project has been carried on with the cooperation of the Navy Bureau of Aeronautics, because of the obvious value of creating negative thrust in maneuvering large flying boats on the water.

A comparison of the water performance of a four engined flying boat with reversible and normal propellers is shown in the accompanying diagram. The short turn at the left is made by applying reverse pitch to the two inboard props increasing the power of the right outboard and left inboard engines, and allowing the others to idle. With conventional propellers (right) the turn is made by increasing the power of the right outboard engine and allowing the others to idle. The relative amounts of power applied to propellers in executing a turn is indicated by the length of the arrows.

Like other Curtiss propeller designs the reversible pitch type is controlled electrically. The pitch change is made very quickly, being accelerated by the same voltage booster unit used for fast feathering. Control is by movement of the switch to the "reverse pitch" position. The cockpit switch and wiring for it constitute the only increase in weight. No engine cooling problem has been encountered in tests even though the reverse pitch position drives air away from the engines. Indications are that the device may also prove to be of some advantage in reducing the landing run of large landplanes.

CESSNA T-50

Twin Engine Cessna. Flight tests are now underway on the Cessna T-50, a five place cabin ship with 2-225 hp. Jacobs engines. A top speed of 193 m.p.h. and a landing speed of 55 m.p.h. are reported. Climb (first minute) is given as 1500 ft. and service ceiling, 22 000-25 000 ft. Gross weight is 5 000 lb. wing area, 295 sq.ft. and span, 42 ft. Price, as yet unannounced, is in the $20 000-$25 000 bracket.



Aircooled Motors Announces Higher Powered Engine for Light Planes

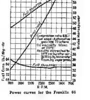
60 hp. FRANKLIN

To meet the growing need for engines of higher power in the light-plane field, the Aircooled Motors Corporation, of Syracuse, N. Y., has announced the new 60 hp Franklin Model 4AC-171, which holds ATC No. 206. Like its predecessor, the Franklin "50", the new "60" carries approval for use of standard 14 mm. automotive spark plugs and a fuel octane rating of 70 or better. Weight of the "60" has been kept down to 159 pounds with the single magneto. Bore has been increased from $3\frac{5}{8}$ in. to $3\frac{7}{8}$ in. Displacement has been increased to 171 cu. in. Overall dimensions are approximately the same as the "50" and many parts are interchangeable between the two engines. The Franklin "60" crankcase is a one-piece aluminum alloy casting, with a removable cover plate at the top for access to connecting rods and other internal parts. Three main bearings carry the crankshaft, with the thrust bearing designed for tractor or pusher mountings. Oil channels are drilled in the crankcase to provide pressure flow to hydraulic valve tappets, main and connecting rod bearings, camshaft bearings, valve mechanism, and other working parts. The four-throw three-bearing alloy steel crankshaft is counterweighted as well as statically and dynamically balanced. It is also drilled for lightness and to provide pressure lubrication to all bearings. The propeller hub inner flange is forged as an integral part of the shaft, simplifying the hub assembly. The forged steel camshaft is also rifle-drilled for lightness. A Celeron camshaft timing gear meshes with the steel crankshaft gear for quiet operation. Connecting rods are steel drop forgings. Pistons are cast aluminum alloy with full floating piston pins, and three rings each. Cylinders and cylinder heads are cast in one piece of British "Y" alloy with a nickel iron alloy liner shrunk into the cylinder barrel. Each cylinder is provided with 912 square inches of heat dissipating fin area. Two overhead valves are provided per cylinder, with nickel iron alloy valve seats and guides, and two Chrome vanadium springs per valve. Valve rockers are force fee lubricated with oil spray to the stems and springs. Wilcox-Rich hydraulic valve tappets provide automatic valve adjustment. Oil supply is carried in a wet sump crankcase, with a normal capacity of four quarts. Oil is fed through the lubrication system by a positive gear type pump. The Stromberg up-draft carburetor is mounted directly on the crankcase with integral intake passages cast in the case, serving to warm the intake mixture and cool the crankcase oil.

A complete new production line has been organized at the Aircooled Motors plant to handle production in quantity of the Franklin "60" and a total of 33 strategically located service stations have been established throughout the United States, Canada, and Alaska, to insure Franklin owners of prompt and expert service.

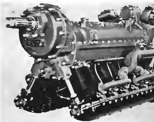
Specifications of the Franklin "60" Aircraft Engine, Model 4AC-171 as supplied by the manufacturer are:

Approved Type Certificate	No. 206
Maximum normal rating	60 hp. at 2350 rpm
Cruising rating	42.5 hp. at 2100 rpm
Bore	3-7/8 in.
Stroke	3-5/8 in.
Compression ratio	6.25 to 1
Piston displacement	171 cu. in.
Fuel	70 octane or better
Fuel consumption at rated hp.	.56 lb./hp./hr
Fuel consumption at cruising	.555 lb./hp./hr
Spark plugs	Champion J-10 or Scintilla 14 AB
Carburetor	Stromberg NA S3
Magneto	Bendix-Scintilla



Power curves for the Franklin 60

A RANGER at 1.28 lb. per hp.



SGV-770B-6 has 500 hp. takeoff rating on 87 Octane Fuel

INTRODUCTION of the Ranger inverted Vee-12 air cooled engine Model SGV-770B-6, recently granted ATC No. 207, gives America the lightest engine of this type, in lb. per hp., in the world, and the lightest specific weight of any aircraft engine under 1,000 hp. operating on 87 octane fuel. The approved take-off rating is 500 hp. on 87 octane fuel up to 1,700 ft. altitude. The normal rating of 420 hp. applies from sea level to 5,700 ft. altitude, as the engine is supercharged. A modification of previous Ranger designs, the new engine incorporates the typical under-head cam valve operation feature, and is geared 3:2 from the crankshaft to the propeller. Principal refinements over previous designs consist of an improved type supercharger impeller, and use of steel backed copper-lead main and connecting rod bearings, in place of the cadmium silver type. Specific weight of the engine is 1.28 lb. per hp. and frontal area is only 28 by 32 in., said to be about one third that of a current radial engine of equal power. A table comparing the new Ranger with six modern European engines of similar design shows it to excel by a wide margin in power per pound of engine.

The following table lists the comparative figures for the Ranger and six of the new European engines:

Engine	Model	Spec. Wt. #/hp.	Reg. Dry Wt. lb.	Take-off hp Rating	Normal hp. and altitude rating
Ranger	SGV-770B-6	1.28	640	500	420@5 700
DeHavilland	Gypsy-12	2.09	1038	525	420@7 500
Hirth	312-B	1.34	605	450	360@3 850
Argus	AS-410	1.47	582	450	340@3 950
Renault	12-S	1.70	849	500	450@13 200
Walter Sagitta	I-MR	1.52	830	500	550@7 550
*Potez	12-D-00	1.45	730	500	420@3 500

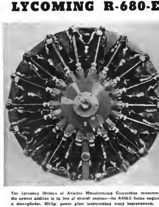
* This engine is a flat 12, but is included as it is in the same class as the others.

Specifications Ranger SGV-770B-6

	BHP	RPM	Alt. Ft.
Maximum Power for Take-off	500	2950	S.L. to 1 700
Normal Rating	420	2950	S.L. to 5 700
Recommended Cruising Limits	300	2500	S.L. to 10 500

Fuel Consumption: Min. at 300 h.p. Cruising	0.52 lb/BHP/hr.
Fuel Ranger Spec. No. 1008	CFR 87 Octane
Oil Consumption at Rated Power	0.025 lb/BHP/hr.
Oil Consumption at Cruising Power	0.015 lb/BHP/hr.
Bore	4 inches
Stroke	5.125 inches
Displacement	773 cu. inches
Compression Ratio	6:1
Blower Ratio	8.54:1
Gear Ratio, Crankshaft: Propeller	3:2
Propeller Shaft Rotation	R. H. Tractor
Overall Length	61.312 in.
Overall Height	32.25 in.
Overall Width	28.00 in.
Dry Including Standard Equipment	640 lb.

LYCOMING R-680-E



The Lycoming Division of Aviation Manufacturing Corporation announces the newest addition to its line of aircraft engines—the R-680-E Series engine, a nine-cylinder, 300-hp power plant incorporating many improvements.

—AVIATION— RADIO

Dialing the Air Waves with Don Fink

Checking Frequency

Frequency limit monitor makes checking of aircraft transmitter frequencies simple

THE REGULATIONS of the Federal Communications Commission regarding frequencies of aircraft transmitters can best be met by periodic checking of the frequency against a suitable standard. A recent announcement of the RCA Aviation Radio Division in Camden, is the type 303-A frequency limit monitor, suitable for frequency limit measurements for all classes of transmitters but particularly adaptable to aircraft work. The limit monitor may be used without any auxiliary apparatus provided that the transmitter output to be measured may be brought within a few feet of the monitor itself. This may be inconvenient in checking transmitters which have already been installed in planes. In this latter case it is possible to separate the transmitter from the monitor by as much as 300 ft, by employing a small coupling coil connected to a ½-in coaxial cable. Such an installation may be made permanently at an airport test office with the far end of the cable situated at a convenient position on the airport or in a hangar.

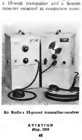
The frequency of a transmitter in actual operation at some distance from the airport, may be checked by employing any suitable radio receiver and a beat frequency audio oscillator. In this case the frequency monitor is coupled to the receiver input and the receiver is turned to the frequency of the station to be measured. The frequency monitor provides a signal which mixes with the incoming signal from the plane. The two signals produce a beat note in the loudspeaker of the receiver. The beat oscillator is then used to determine the frequency of the beat note and this frequency in turn gives the frequency interval between the standard of the frequency monitor and the incoming signal. The monitor may be used with a crystal either on its fundamental or on the second harmonic. This is particularly useful in the case of the frequency 3105 kc and 6210 kc. The price of the table model is $204, that of the rack type $191.25.

The frequency limit monitor covers a range from 1500 kc or 45 mc and is fitted with a lamp which lights if the transmitter frequency shifts from its assigned value by more than the limit set on the dial. The frequency deviations which can be indicated are within 0.005 per cent, that is between 50 cycles and 20,000 cycles, depending upon the carrier frequency. The monitor also finds use, of course, in conjunction with airport transmitters and in any ground installation where the frequency monitor may be incorporated as an integral part of the transmitter installation.

Low-Cost

Two-Way system weighs 25 lb. and sells for less than $200

AIR RADIO & INSTRUMENT Co., 5214 West 63rd St., Chicago have recently added to their line of light weight and low-cost aircraft radio equipment a 10-watt transmitter and a beacon receiver mounted in companion cases.



Air Radio's 25-pound transmitter-receiver

The two units together weigh 25 lb including the power supply.

The transmitter has 10 watts crystal-control output, designed to be operated at 3105 kc. and at any other single frequency between 2000 and 6,500 kc. A tapped antenna coil is used for adjusting the output at either frequency. Switching from one crystal to another is accomplished by a toggle switch. An ordinary volume control is included in the microphone circuit. The power supply may be operated from 6- or 12-volt battery with 10 amp input at 6 volts and 5 amp at 12 volts. A vibrator power supply is used. The standby current is 20 per cent of the full load current.

The receiver is a five-tube superhet covering a range from 195 to 405 kc provided with sensitivity and volume control. The dial is calibrated in kilocycles. Power for the receiver is obtained from a vibrator consuming 3½ amp. at 6 volts or 1½ amp at 12 volts. The units are 11 in high (including the power supply) and 6x7 in. horizontally. Price of the transmitter is $99, of the receiver $75.

Battery Operated

Portable Transmitter and Receiver Do Not Depend on Power Supply of Plane

ESPECIALLY USEFUL for small planes, such as the Taylor Cub, which do not have auxiliary power supply is the new transmitter receiver combination announced by the Aerovoice Co. of Islip, L. I., N. Y. The new equipment is known as the Airmaster midget radio transmitter and receiver, and is completely dry battery operated. It is claimed that normal operation permits about one year's life from the batteries. The transmitter is a crystal controlled oscillator amplifier type and can be modulated 100 per cent. The transmitter utilizes filament type tubes which heat up almost instantaneously. It is thus possible to control the filament directly from the push-to-talk plug on the microphone which turns on both filament and plate supply simultaneously. This arrangement eliminates the necessity of standby power, and makes for long battery life. The transmitter is designed to operate only on 3105 kc and is supplied with a crystal for this frequency. The transmitter is extremely light, weighing only 3 lb. 2 oz., while the microphone and table weigh 10 oz. Battery box with a complete complement of batteries weighs 8 lb.

The receiver, which likewise uses filament type low-drain tubes, has two frequency ranges, from 180 to 420 kc for beacon and weather signals, and from 2000 to 4500 kc for usual ship-to-ship communication. Sensitivity of the receiver is such that radio range beacon stations may be received at a distance of 100 miles. The transmitter, when operated with a fixed antenna has a range of 15 to 20 miles, but this may be extended to about 50 miles by the use of a trailing antenna. The entire equipment weighs less than 20 lb. and sells complete (both transmitter and receiver) for $155.

Fairchild D-f

Gets CAATC Approval After Extensive Tests. Unusual Frequency Indicator Employed

A NEW MODEL of the Fairchild Radio Compass, Type C-6 has recently been awarded the CAA Test Certificate (No. 320). The unit tunes the beacon band only, from 195 to 415 kc, and is suitable for visual indication, aural-null indication, or for use as a beacon receiver. The remote control unit presents a very neat appearance, and is designed for easy operation. Tuning is accomplished through a crank, geared to a flexible shaft leading to the receiver and to the frequency indicator. The latter indicator takes the form of a "speedometer" type counter with large figures. Only the frequency nearest the tuned frequency, to the nearest kilocycle, appears on the dial. Other controls are provided for increasing the audio and radio sensitivity, for switching from a-v-c to manual gain control, and for switching from loop to compensating antenna, necessary for visual indication. The entire compass equipment consists of the receiver proper, a power junction box, the remote control unit (see illustration), the visual indicator, a remote rotating control which connects with the loop, and the loop itself mounted within a streamlined housing.

Control panel of new Fairchild d-f

Trans-Atlantic

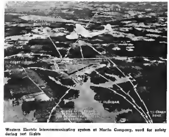
British Imperial Airways Installs New Radio Equipment for Trans-Oceanic Service

WORD has come from the Imperial Airways that standard radio installations have been decided upon for the Empire flying boats in preparation for regular Trans-Atlantic service. The Marconi Company of Great Britain has installed two-way communication on medium and short wave as well as equipment for direction finding and homing flights. Adcock direction finding stations will be located at both sides of the Atlantic to determine the position of the aircraft and to transmit bearings to the ships during flight.

An auxiliary radio equipment which is extremely compact and light in weight has been produced by the Hermes Company for use on the flying boats. This equipment is known as the Hermes trans-receiver type 1050-51 and consists of a transmitter, receiver, and dynamotor power supply housed in a single casing and weighing complete 43 lb. The dimensions of the case are 22x12x9 in.

Trans-receiver for transoceanic auxiliary service

The output of the receiver is of dual type, either for low resistance headphones or a loudspeaker. The output of the transmitter is 15 to 20 watts, obtained from an input of 30 to 35 watts. Power is supplied by dynamotor operated directly from the battery supply of the ship.

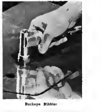


Western Electric intercommunicating system at Martin Company, used for safety during test flights

BUYER'S LOG BOOK

What's New in Accessories, Materials, Supplies, and Equipment

A small pneumatic nibbler of revolutionary design has been introduced by the Buckeye Portable Tool Company, of Dayton, Ohio. Weighing only two pounds, and consuming but nine cubic feet of air per minute, the Buckeye nibbler has a cutting speed up to ten feet per minute in 18-gauge duralumin. It is capable of cutting shapes in panels or sheet-stock without breaking-in from the edge of the sheet. It consists of a compact tool ending in a punch and die which can be turned in a radius as small as one inch, the motor housing serving as a hand grip. The punch operates at 2500 strokes per minute and leaves an exceptionally smooth edge requiring little further attention. To cut out any internal shape it is necessary only to drill or punch out a hole one inch in diameter, through which the head of the tool is inserted. After being inserted in this hole the nibbler is pushed in any desired direction by the operator, following either line or template. Forward pressure required is very slight.—AVIATION, *May, 1939.*

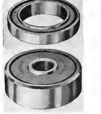


Buckeye Nibbler

A handy time saver disc giving correct size of tap drills for the U. S. gauge threads, together with a decimal equivalent chart, is now being distributed free of charge by the Dayton Rogers Manufacturing Company, of Minneapolis, Minn. On the reverse side there is listed the tap drill sizes of National coarse machine screws and National fine machine screws, together with a complete listing of tap drill sizes for the National pipe thread standards. Printed on a grease and oil resisting material, this little device should be handy to have around any aircraft shop.—AVIATION, *May, 1939.*

Dayton Rogers time saver

Designed for larger aircrafts, the aircraft division of the Fafnir Bearing Company has announced two new series of extra heavy capacity type bearings made in ranges adaptable to all modern large airplanes. Designated the KH and DH series, these bearings are pre-packed with lubricant and are highly corrosion resistant. KH is of single row and DH of double row design. Another new series of ball bearings is the KB, designed primarily for torque tube applications requiring bearings with self-contained seals and a high degree of load capacity.—AVIATION, *May, 1939.*



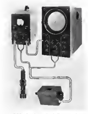
Fafnir series KH and KB bearings

Multiple conductor cables specially designed for aircraft for use with instruments, control devices, multiple light circuits, switching apparatus or any inter-connecting multiple circuits, are being made by the Boston Insulated Wire & Cable Co. of Boston, Mass. These are made with an outside cotton covering, lacquered for use in conduit or with a rubber sheath for protection from moisture and abrasion. Tinned copper shielding may be furnished on certain individual wires, or certain pairs of wires, over the outside cotton braid covering, under or over the rubber sheath. The number of conductors may be from 2 up to 30, each color coded.

The Benton aircraft spark plug is now on the market with a strong array of desirable features. It is internationally distributed by the O. J. Whitney organization, and manufactured by the oldest U. S. maker of mica spark plugs. The Benton plug uses the mask type electrode design for long wear and simplicity of adjustment. The unshielded plug is made in two parts, and the shielded plug in three parts, and replacements may be made on each of any of these parts. Standardized parts makes stocking Benton spares extremely simple.—AVIATION, *May, 1939.*

Two torque indicating wrenches have reached the market recently in response to the widely recognized need for greater uniformity of nut and stud settings. The No. 56 Bonney torque indicating wrench is offered at a popular price by the Bonney Forge & Tool Works of Allentown, Penna. It weighs 3 lb., has an overall length of 23 in., and is equipped with ½ in. square adaptor. An accurately calibrated scale is located on the shaft near the handle grip, reading from 0 to 200 ft. lbs. Displacement of the pointer is accomplished by the movement of the spring steel handle. A sound reading feature is incorporated in the torque measuring wrench offered by the J. H. Williams & Co., of New York City. This wrench gives a sharp sound signal for any

desired torque from 35 to 200 foot-pounds by first setting the sound scale. A sight reading scale is also provided for visual check on tension. This wrench is 19½ in. long and is equipped with a compact head which can use any socket having ½ in. drive-opening. It is known at the Williams torque Measurrench No. S-57.—AVIATION, *May, 1939.*



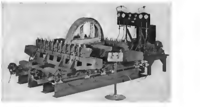
RCA electric engine-indicator unit

RCA research laboratories have perfected an electrically operated engine-indicator diagram equipment for accurate and dependable measurement of rapidly changing cylinder pressures. The RCA unit eliminates inaccuracies due to friction and inertia of mechanical instruments. It is composed of a pressure unit of revolutionary design, a catode-ray oscillograph, an amplifier, and a synchronizer unit. The pressure unit, unaffected by temperatures up to 350 deg. Centigrade, is built to withstand pressures to 5,000 lbs, and converts rapidly changing pressures into electrical impulses which are amplified and pictured on the screen of a cathode-ray tube. Accuracy of the unit is extremely high for engine speeds over 1,000 r.p.m. Features claimed for this equipment include: easy tracing of pressure curves of any form of dynamic pressure; simple and accurate orientation of any point on the diagram with respect to the crankshaft angle, simple electrical calibration of pressure at any point in the pressure diagram and flexibility of the system, permitting detailed study of any portion of the cycle.—AVIATION, *May, 1939.*

Southwark 2050 ton press

Six hydraulic presses designed for aircraft press work have recently been delivered by the Eddystone plant of the Baldwin-Southwark Corporation. Three of the presses are of 280-ton capacity, and three are of 2050 ton capacity. Featuring fast operation of the moving platen to and from the work, both presses are of the double action type, actuated by rotary oil pumps, electrically driven. The 280 ton presses have a plate 60 by 66 in. and a stroke of 24 in. The 2050 ton presses have a stroke of 44 in. and a table 80 in. wide and 120 in. between side housings.—AVIATION, *May, 1939.*

A two cylinder hydraulic press is offered to the aviation industry by the Engineering and Research Corp., Riverdale, Maryland. It is designed to form sheet metal by forcing a wood or metal male die upward into the work, while two edges are restrained with clamps. The capacity of the machine is 150 tons, sufficient to form 1/16 in. thick sheets of iron or mild steel 60 in. wide, or a total of nine ft. six in. width can be handled in lighter material. Another novel product offered by the same firm, and one of wide application to aircraft metal forming problems, is the ERCO sheet metal shrinker. This machine consists of two sets of jaws which grip the work and then are themselves forced together to shrink the metal between them. The effect is the reverse of stretching metal with a bumping hammer. With this machine it is possible to bend angles in curves with the leg on the inside, or to form double curvature similar to that done on a bumping hammer, but with higher crowned shoulders. —AVIATION, *May, 1939.*



Left: 150 ton ERCO Press

Above: ERCO Sheet Metal Shrinker

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

MAY 1939

DANIEL SAYRE
C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield, *Washington*
E. R. Leckie, *New York*

Hinckley gets chairmanship of CAA

(Story on page 52)

IN GERMANY: (So it is reported) Flight Captain Dieterle (shown here) put a new Heinkel pursuit (probably not shown here) over an official three kilometer course in the prescribed FAI manner and thereby established a new World's record for absolute speed at 746.66 kilometers per hour—something over 462 m.p.h.

Wide World

International

IN AMERICA: Col. Charles A. Lindbergh arrived on the Aquitania for his second visit since sailing on his self-imposed exile in Europe. Few days later he renewed his reserve commission in the Air Corps and made a report to the NACA.

OUR DEFENSE PROGRAM, meanwhile, gathered speed. Congress acted on several key measures (see page 54). The Air Corps held competitions at Wright Field for pursuits and attack bombers. Below, the North American entry in the latter. After an excellent preliminary showing, it crashed near Dayton on a test flight.

International

NATIONAL AVIATION

Hinckley Heads CAA

Noble moves to Commerce; Warner named

April 12th, eight months almost to the day from the occasion of his taking oath as the first chairman of the Civil Aeronautics Authority, Edward J. Noble resigned to become Assistant to Secretary of Commerce, Harry L. Hopkins. As soon as Congress passes the necessary legislation his new title is to be Under Secretary of Commerce.

At the time it announced the acceptance of Noble's resignation, the White House indicated that Robert M Hinckley, one of the five original appointees to the Authority, would be designated as Chairman to succeed Noble. To fill the vacancy thus created in the Authority, President Roosevelt nominated Edward Warner. Appointments of all five members of the Authority were effective as of December 31, 1938 Grant Mason was appointed for three years, Oswald Ryan for four, Hinckley for five years; Harllee Branch for six years, Noble for two. Warner's appointment, being made to replace Noble, will therefore expire on December 31, 1940

Robert Hinckley, the new chairman, has acquired the reputation in Washington as being one of the most energetic members of the Authority. Before taking his place upon it he was a well-known figure in his home state of Utah as an automobile dealer, as a member of the Legislature, and since 1934 as a W.P.A. Administrator. Since 1925 he had held an interest in an airplane operating company at Ogden and been an avid air traveler. Much of the push behind the Authority's program of pilot training has been ascribed to him.

Edward Warner needs no introduction to Aviation readers. During the past 20 years he has (1) organized and directed the courses in aeronautical engineering offered by M. I. T, (2) served as Assistant Secretary of the Navy for Air, (3) been editor for a half dozen volumes of Aviation magazine, (4) been Vice Chairman and author of the report of the Federal Aviation Commission, (5) been a member for many years of the N. A. C. A. and an active consulting engineer. For the past few months he has served as special advisor to the Authority

Harris & Ewing

C.A.A.'S NEW CHAIRMAN, Robert M. Hinckley, left, explains some of the finer points of the Civil Training Program to Rep. Clarence F. Lea, Chairman of the House Interstate Commerce Committee. The President asked $10 000 000 for the program in his defense message. The Senate scaled that to $7,300,000. Rep. Lea's committee cut it to $5 675,000

We're In At Both Fairs

U. S. Aviation Exhibit, Inc., Signs for big N. Y. Building

A comprehensive and dramatic display of the country's aviation industry—covering the fields of commercial transportation, air defense and private flying—was assured for the New York World's Fair 1939 early last month when a newly formed group representing the industry, assumed control of the Aviation Building

In a ceremony at the main entrance to the building, Captain Eddie Rickenbacker, President of the U S Aviation Exhibits, Inc., handed a check to Grover A Whalen President of the Fair Corporation, in return for a contract covering purchase of the building—at a reported price of approximately $300 000

The exhibit will be divided into three features

Wings of Travel—directed by representatives of commercial air transportation and of airports. It will be featured by a cross-section view of a composite modern transport plane; displays revealing the procedure and devices used to insure safety; and displays showing frequency and comprehensiveness of schedules and economy and comfort of air travel. In this connection the accessibility of the modern new North Beach Airport is considered particularly auspicious. With special buses running back and forth between Aviation Building and the Airport, thousands will be able to see how a plane is constructed, its safeguards and its comforts—and then actually experience a flight.

Wings of Defense—in which the air corps of the United States Army and Navy will participate It will include various types of army and navy aircraft.

Wings of Recreation and Commerce—stressing the significance of the new Civil Aeronautics Authority which is giving particular attention to private flyers. The National Advisory Committee for Aeronautics and the U S Bureau of Standards also are expected to participate

In addition to the three outstanding divisions there will be group displays, featuring the production or use of various products related to flying—such as power plants, propellers, navigation instruments, radio, ignition and carburetion, oils and fuels, aircraft structure, equipment and accessories, basic materials, airport equipment All such products will be displayed to show their functional use and importance in aviation

Besides President Rickenbacker, officers of the U. S. Aviation Exhibit, Inc., are J. A. B. Smith, Vice-President; Courtlandt S. Gross, Vice President; Donald W. Douglas, Vice-President; E. J. Webb, Secretary and Treasurer; A. R. Christie, Assistant Secretary and Treasurer. G. A. Parsons is general manager of the organization.

Cleveland Program

Bendix, Greve and Thompson races worth $85,000

The recently issued official schedule of events of 1939 Air Races shows a total of $85,000 posted for the various events Saturday, September 2nd, will be featured by the Bendix Trophy Race, as usual a speed dash from Los Angeles to Cleveland First place will bring $9,000; second place $5,000, third place $3,000, fourth $2,000; fifth $1,000 $2,500 additional is provided for a new record between Los Angeles and Bendix, N J. Another $2,500 will be split between the first three pilots making the best time between Los Angeles and Bendix Still another $2,500 is posted for the fastest time made by a woman pilot between Los Angeles and Cleveland

Sunday, September 3rd, will feature the Greve Trophy Race and will pay a total purse of $15,000 divided as follows: $8,000 for first place, $4,000 for second, and so on down to $100 for twelfth place. An extra prize of $1,000 will be awarded to the winner provided his speed exceeds the present record of 250 88 m p h The race, of course, is open to only planes with engines of 549 cubic inch displacement or less The distance will be 20 laps on a 10 mile course

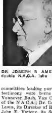
Monday, September 4th, the Thompson Trophy Race will climax the meeting A total purse of $35,000 will be distributed $16,000 to first place, $8,000 for second place; $4,000 for third, and so on down to $100 for twelfth place. An extra $2,000 and a special award posted by the Allegheny Ludlum Steel Corporation will be presented to the winner provided he breaks the present record of 283 419 m p h Distance is 30 laps around a 10 mile course

Airplanes entered in the Bendix will not be allowed to enter either the Thompson or Greve Races. This does not apply to pilots. A maximum of 12 airplanes will be allowed in any closed course race. All planes entered for the Thompson and Greve must qualify before 5 P M. Friday, September 1st Qualifying speeds For the Greve 220 m.p.h; for the Thompson 240 m.p.h.

Congress Almost Says No

Sunnyvale base for NACA rescued on Senate floor

On February 23, a group of witnesses representing the National Advisory Committee for Aeronautics presented their case before a House subcommittee on appropriations. March 31, much the same group appeared before a subcommittee of the Senate From a technological viewpoint the group's standing was irreproachable. Before both sub-



DR JOSEPH S AMES would double N.A.C.A. labs

committees leading parts in the testimony were borne by Dr Vannevar Bush, Vice Chairman of the N A C A; Dr George W Lewis, its Director of Research; John F Victory, its Secretary, and others of similar distinction

From a technological viewpoint, the group's stand was likewise almost beyond serious question Since its creation during the War, the N A C A had always been very modest in its demands for funds. Now in view of the complex world situation and the emergency defense program for air expansion, just authorized by Congress, the N A C A was seeking appropriations for enlarged activities The group asked for a small increase in its running budget for Langley Field for the fiscal year of 1940 That was granted It asked for $2 140,000 for increasing the equipment of that field That was granted

It asked likewise for a fund of $10,000,000 to build a second major research base at the big

(Continued on page 72)

CAA Reports on Ports

Recommends Govt. assume building burden

Section 302 (c) of the Civil Aeronautics Act of 1938 directed that "The Authority shall, through the Administrator, make a field survey of the existent system of airports and shall present to the Congress not later than February 1, 1939, definite recommendations (1) as to whether the Federal Government should participate in the construction, improvement, development, operation or maintenance of a national system of airports, and (2) if Federal participation is recommended, the extent to which, and the manner in which, the Federal Government shall so participate"

The assignment proved no simple one It meant the assembly of data not only on the physical features of some 2,174 landing fields, but also, on their financial case histories Engineers and crews, working systematically across the country, actually visited some 90 per cent of all the airports in the United States. Then after the data was collected its digestion and coordination posed another formidable problem On February 1st a preliminary report was submitted to Congress to comply with the letter of the law Then after some two months further intense work, largely it is said on the part of Edward Warner, at that time special adviser to the Authority the final report was finished and transmitted to Congress

We have little room here to do anything save summarize its five page summary

"The total expenditure on airports in the present time has been just over $325,000,000 The expenditure prior to 1933 was about equally divided between municipal and private airports. Since 1933 work relief programs .. have been responsible for most of the air port development. About $140,000,000 of Federal funds have been spent on airports in

THE WASHINGTON WINDSOCK

by BLAINE STUBBLEFIELD

C.A.A. Shuffle Looks All to the Good

Chairman Noble's hop to Hopkins drew Washington comment almost entirely from the Commerce angle Noble can do the Administration a lot of good in his new spot, most think, as a tame capitalist to decoy wild ones within range of Harry's appeasement salt shaker Many report Hopkins is seriously ill and Noble may well be headed toward the post of Sec'y.

The change of chairmen may be all to the good for the CAA Hinkley has proved energetic and will have a chance now to get a lot of credit for speeding things up (Sample: the Mid Continent Rate Case) Best of all, Warner's appointment to Noble's vacancy takes away that amateur stigma. Warner's twenty years of top flight aeronautical experience are enough background for any committee Political shifts are not major Hinkley, of course, is a strong Hopkins man. Warner is first and last a technical man. The President passed him up last year simply under patronage pressure.

After less than a year of CAA, aviation again faces the possibility of a shakeup in federal control The future is unpredictable as yet and this is only to suggest that you look often behind the front scenery Number one threat is the Government Reorganization Law just passed, plus failure of CAA to get exemption from it as other important agencies did.

This reorganization law says that the President's proposed changes must be submitted to Congress and that they go into effect only if both houses fail to reject them at the end of 60 days during which Congress is in session No changes can be put into effect during recess. The Administration probably cannot get around to mapping a CAA change this session So any reorganization would not take effect till about March 1940

Air rates by ICC again? Col. Edgar S Gorrell, before committees hearing evidence on bills to set up a super-colossal ICC over all transportation, has made an effective plea for exemption of air transport. The bills would take away the rate-making powers of CAA, which is the main function of that 5-man authority Looks as if the authors of this ICC legislation had mistakenly assumed the aeronautic Act did not provide for rate control Chances are nothing will come of it.

That airport lobby will be back in Washington to get that $450,000,000 suggested by the CAA—for their home towns. If they can't get that, which is doubtful while Congress is having economy cramps, they'll settle for the $230,000,000 program—or even the $128,000,000 one CAA is commended by some for a swell technical job on the airport survey and for its minimum program, but is criticized by others for not taking a firm stand against developing hundreds of fields for use by a handful of airplane owners Get cozy with certain officials and they'll admit that national defense and air transport are the main excuses for big airport spending

Spare parts: Public Health Service aircraft quarantine at Miami caught five mosquitos during 1938 Mr Noble said the day before he went to Commerce, that Pan American's request for $2,758,218 for 52 transatlantic trips sounded pretty high We are far ahead or behind Germany in aircraft development depending on whom you talked to last House passed a bill authorizing War Department to sell gas and parts to foreign military attaches having planes in U S. For years other countries have serviced U S Attache planes without charge

EDWARD WARNER did a big job for the C.A.A. then got a big job on it.

the six years, as contrasted with just over $40,000,000 from all other sources combined .

"A study of the facilities and equipment showed only 1,112 civil airports possessing hangars, only 82 with fueling facilities, approximately 230 with reasonably adequate lighting provision and only 231 with hard-surfaced runways.

"Four classes (of tentative standards of airport classification) are described calling for runway lengths of at least 1 500, 5,500, 3,500 and 4,500 feet respectively together with various specified types and amounts of equipment. There is not in the United States at the present time a single field which qualifies for the highest class; and only 36 in the third class and 178 in the second.

"The total maintenance expense on all the airports of the United States was somewhat over $6,000,000 in 1937 or an average of a little under $3,000 per airport. The average gross income for that year was about half the expense . . approximately 15 per cent of all the airports reporting had net operating profits

"An actual airport plan, based on a separate study of a very large number of possible locations has also led to the conclusion that a system of about 3,500 airports would be a reasonably complete one for the United States . . Just over 800 fields with 3,500 foot runways or better, another 1,250 with runways of 2,500 feet, the remainder with 1,500 feet at least.

"A study of the cost of developing the existing system (of 2,174 airports including intermediate fields), to various degrees and in accordance with various alternative plans, shows a prospective net cost beyond the completion of projects for which funds have already been allocated . . . of about $128,000,000 to bring the airports actually designated as airmail stops to a properly high standard quality. That would include the creation of about 40 fields of the very highest class. To extend the work to cover the more comprehensive system of 850 airports . . . would increase the total net cost to about $230,000,000, while the total net cost for the completion of the system of 3,500 airports would be approximately $435,000,000.

The report proper ends in three full pages of recommendations. Boiled down, they include the following principal points. "The development and maintenance of a system of airports and seaplane bases should be recognized in principle as a matter of national concern . . Such a system should be regarded, under certain conditions, as a proper aspect of Federal expenditure . . The highest preference should be given to airports which are important to the maintenance of safe and efficient operation of air transportation . . . and to those rendering special service to the national defense . . At such times as the national policy includes the making of grants to local units of government for public works purposes or any work relief activity, a proportion of the funds involved should be allocated to airport purposes . . Whenever emergency public works programs may be terminated . . or curtailed Federal assistance for airports should continue through annual appropriations for that purpose . . Expenditures at these periods should be limited to projects of exceptional national interest . .

"There should be a provision of supplementary funds to enable the Federal government to increase its share of the total expense . . (of) at least 25 per cent of the amount of money that is to be designated for airport work from the regular work relief funds . .

"At the present time there could be efficient use of $100,000,000 of such regular public works or work relief funds together with $25,000,000 of supplementary funds . . .

"There should be no direct Federal contribution to the cost of maintaining airports, other than Federal airports, except that the Administrator in the Civil Aeronautics Authority may, in accordance with the Civil Aeronautics Act, and so far as available funds permit, assume the cost of operating and lighting equipment or other air navigation facility as a part of the cost of operation of the federal airways system"

DEFENSE

Progress to Report—

Congress nears end of work on defense program

By the end of May probably all of the several national defense measures before Congress, most of them contributing to expansion of the nation's air strength, will have been enacted Immediate placement of orders will follow In fact Army's Judge Advocate General has already okayed increasing existing contracts anticipating appropriations rather than wait for Congress to vote the money

Army Expansion Authorization—is now Public Law No. 18, 76th Congress. It authorizes the War Department to equip and maintain not to exceed 5,000 *serviceable* airplanes, for which an appropriation of $300,000 000 is authorized About $170,000,000 will actually go into purchase of airplanes The $50,000,000 requested by the President to begin immediate construction of 555 planes is in the regular Army supply bill for 1940 The President has sent a request to the Hill for the other $250,000,000

The expansion bill also authorizes appropriation of $27,750,000 for improvements at Panama; this will include some hangars and other flying facilities It has been definitely decided that none of the $34,500,000 authorized by this bill for "educational orders" will go for airplane development. The Air Corps got all it wanted in other places.

Regular Military Establishment for 1940 also should be law as you read this The committee had already recommended for air on the basis of the old Baker Board figure of 2,320 planes, when the President's request for $50,000,000 additional was received Deducting the $15,000,000 in contract authority, $94,737,281 is appropriated direct to the Air Corps, with some additional amounts to the Signal Corps and to Ordnance for AC service

House Military Affairs was not convinced that the entire $50,000,000 could be spent during the remainder of this year, and so $19,000,000 of the amount was put in the form of contract authorization It should be remembered that the 5,000 maximum plane figure doesn't mean very much The law specifies "serviceable" planes. The War Department could declare many planes not serviceable, and could order as large a total as it got money for

Wide World

DOWN THE WAYS The Navy launches the carrier Wasp at Quincy, Mass., April 4. With a displacement of 14,700 tons, a length of 739 ft., and a beam of 79 ft., it will carry 73 planes.

It seems useless to recount the committee's recommendations by types of craft, since obviously they will be superceded by the new and broader program The committee reports that on December 31 last there were 558 airplanes on order, some under funds that became available as far back as 1935. On the same date, orders had not been placed for 348 airplanes for which Congress had made provision Add to these the 215 in the regular budget for 1940, and the 565 called for in the President's supplemental estimate, and you get the total of 1,690 for delivery during the 18 month period from December 31, 1938, to June 30, 1940 The committeemen set up a Baker Board table of deliveries through 1942 which showed a rapid decline It expressed the opinion that the expansion program would help rather than hinder the maintenance of an even work load

Second Deficiency Bill passed by the House and reported in the Senate carries the $2,378,000 for the National Advisory Committee for Aeronautics. About $238,000 of this sum is for construction at Langley, the rest is for research The House rejected the $10,000,000 cash and contract authority to build another plant at Sunnyvale, but the Senate restored $4,000,000 of it after a general floor debate The project should pass The Administration is strongly in favor of Sunnyvale Every attempt will be made to back it with proper legislation this session if possible There are strong advocates in Washington of not only two research centers, but of four or five throughout the country after the German manner

Navy Expansion Authorization Bill, passed by the House and Senate now in conference, provides for 15 air bases in the two seasons The House delayed it while a junket of congressmen went to Florida to sample the strategic merits of Miami as compared with Jacksonville Also the Hepburn Board was reconvened and asked for further advice. Jacksonville was added to the program at a cost of $17,000,000, and the total is now $66,000,000 Guam is out, to keep quiet on the Potomac and in Tokio, but may turn up in Rivers and Harbors and be developed just the same.

Navy Establishment for 1940 is in hearings before the House Appropriations sub-committee for Navy, and no guess when a report will be made is available The budget recommendation calls for $41,251,047, and the President sent up a supplemental request for $21,000,000—a total of about $52,000,000 for airplanes But the shape of things to come in the air over the Navy may be changed quite a bit by the final form of the air base expansion act, by the outcome of debate on the neutrality law, and by the new implications of 45,000-ton battleships. Again recall that the Navy expansion act of last year set a *low limit* of 3,000 planes, so that, unlike the Army, it has not even a theoretical maximum

Navy Public Works, 1940, has been reported by House Naval Affairs and has cleared House Rules Committee. It appropriates $37,000,000 for shore stations, some seaplane handling facilities will be included.

Neutrality, in various forms, is incorporated in seven or eight bills which are now being considered in hearings by Senate Foreign Relations Whatever is finally done about this will be no less important than a restatement of foreign policy by the United States. The present law empowers the President to embargo arms, munitions and implements of war to nations engaged in dual or civil conflict; and he can forbid shipment of all other supplies to such countries on American owned vessels The country is split wide open on whether to tighten restrictions, or open wide to the democracies. The President wants to arch his neck at Benito and Adolf (even more than Congress will let him) and his side probably will win

Our own hurried air program is closely bound to that of England and France Airplanes will be the star item on our arms export list, double star if Europe fights and the law lets us sell An authoritative representative of Britain speaking off the record to a group of industrialists in Washington, said that both England and France must look to America for huge orders of finished aircraft Neither country in his opinion can possibly expand their production enough to substantially alleviate the demand on the United States

Pilot training CAA's request for $7,300,000 for contract primary training at schools and universities still stands at that figure in Senator McCarran's bill, but the House bill was reported by interstate commerce committee at $5,875,000

International

THREE WHEELED STINGER Two years ago the Bell Aircraft Company of Buffalo set itself a high standard in design originality with its Airacuda combat fighter. Last month, however, its XP-39 pursuit, delivered to Wright Field and purchased along with the Seversky XP-41 by the Army, showed no let down. It has a retracting 3-wheel gear. Its Allison engine is mounted behind the pilots seat, drives a 3-bladed prop through a system of shafts and gears. Its high-visibility canopy is fixed, has a side door.

SCOUTING THE SQUADRONS

Want to make $1 500? The Air Corps needs a good song badly Bernarr Macfadden, the publisher and amateur pilot, has offered the thousand for "something as good as the 'Caissons' or the 'Halls of Montezuma'". But it really has to be that good A committee headed by the wife of General Barton Young has already dropped 500 submitted attempts into the waste basket

The Air Corps' weird luck with its new prototypes during the last few months has been phenomenal On January 23, a Douglas attack bomber, scheduled for almost immediate delivery to Wright Field, crashed in Los Angeles Since then the Corps has lost the twin-engined Lockheed pursuit at Mitchell Field; a new Seversky pursuit and North American attack bomber at Dayton

The Navy has launched the "Wasp" and accepted a bid (of $31,800,000 from the Newport News Shipbuilding and Dry Dock Company) on a sister ship to be called the "Hornet". If the two after that aren't called the "Whirlwind" and the "Cyclone", Curtiss-Wright should sue.

More shifts in high Navy command: Captain John H Hoover, commanding the Lexington, to be Chief of Staff and aide to the commander, Aircraft, Battle Force, about June 17

Captain Alva D Bernard, Chief of Staff and aide to the commander, Aircraft, Scouting Force, to command the Lexington

Captain John S. McCain, commanding the Ranger, to command the Air Base, San Diego, relieving Captain Arthur La Roy Bristol, who will be commander, Patrol Wing 2, Aircraft, Scouting Force, based at Pearl Harbor

Commander Ralph F Wood, commanding the Wright, to command the Ranger; recommended for promotion to captain

AVIATION ABROAD

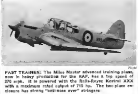
French Boost Production With Foreign Engine

A SHOT in the arm for French production should result from strenuous efforts to iron out the engine shortage All along the engine situation has been the bottleneck in French rearmament—both engineering and production troubles have combined to keep output down With new plants for Hispano and Gnome-Rhone under way, the French have been doing a lot of shopping around for engines, in England as well as in the U. S, as production schedules call for 12,000 in the next two years. To boost the immediate supply a deal has been turned under which Rolls-Royce will furnish 1,145 hp. Merlins at a rate rumored at around a hundred a month, which will go into Amiot 350 bombers . . . For the longer pull the French are buying up rights to foreign engines and turning their production over to firms outside the aeronautical industry The Talbot auto works has been assigned Pratt and Whitney Twin Wasps. Alsthom-Sigma, big electrical equipment makers, will start in soon on Bristol sleeve valve engines, drawing on England for parts at first; by 1940 all-French models are expected Loire and Oliver 45 bombers will probably take most of these engines

Trans-Asia Line In Quick Stop. Japs in Pacific

A PROMINENT missing link in the world airline map is a Europe-Orient service running straight across Europe and Central Asia in a direct line instead of the long way around via India The Germans have planned one for years and made some survey flights, but civil wars and minor fracases along the line never settled down enough to permit operation. The Russians and Chinese finally got together to start one, a Chungking-Hami-Moscow service to go through in four days The hex on this route still seems to be active, for after the inaugural flight it was announced that regular service would be indefinitely delayed for more preparation of the route

Meanwhile the Japanese finally started a Yokohama-Saipan-Palao line stretching 2,600 miles down by Guam to her mandated Pacific Islands. Without any connections to other Pacific lines, this is an outstanding route in commercial uselessness, and it's not likely, for military reasons, that any connections will be arranged.



Flight

FAST TRAINER: The Miles Master advanced training plane, now in heavy production for the RAF, has a top speed of 270 mph. It is powered with the Rolls-Royce Kestrel XXX with a maximum rated output of 715 hp. The two place enclosure has strong "anti-nose over" stringers

Acme

TWIN-ENGINED FIGHTER: A new French prototype of striking interest because of its resemblance to American thinking along bi-motor lines, the Potez-630 mounts two 670 hp. Hispano Suiza engines. Climb to 4,000 meters—5 minutes; Top speed—"somewhere around 300 mph"

Acme

ANOTHER FRENCHMAN: One of the newer Bloch products, this single-seater is powered with a Gnome and Rhone 950 hp engine, is also reported to do "something around five miles a minute". Purchases of big foreign engines should boost French performance as well as production

Atlantic Battle Plans

British to refuel Empire boats. French beef up Lieut.

BRITISH Atlantic plans for 1939 haven't been formally announced yet, but what with one thing and another a pretty consistent picture can be put together Item one is that there won't be any serious attempt to try landplanes on the run—the two Albatrosses designed for this service are having their extra tanks taken out and will be fitted up for passengers on Imperial's European lines. Imperial was hard hit for equipment when the famous Ensigns had to be pulled out of service about as soon as they went in, as an ambitious schedule expansion over European lines had been announced for this summer

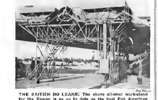
Nobody knows when the Ensigns will be back; apparently they suffered from acute lack of horsepower for takeoff and longitudinal control troubles. Pious hopes are expressed that more engine boost at sea level and constant speed props will haul the ponderous pride of the Empire into the air at a respectable rate As for the controls, the official explanation is that the trouble was all mechanical and not aerodynamic, and that a little grease and revision here and there will fix things up dandy

The main Atlantic work this summer will be done by super-Empire boats helped along their way by Sir Alan Cobham's Flight Refuelling Ltd., which has taken on the job of pumping around a thousand gallons of gas into them after takeoff Cobham claims his system is foolproof and doesn't require any special experience or dodging around on the part of the boats, the landplane tanker doing all the hard work. After getting off, the boat lets a line out of its tail, which is fished for and picked up by the tanker, after which the boat hauls in the line again with the tanker's hose attached The nozzle is hitched to a coupling in the tail of the boat, and the gas transferred by gravity at around 150 gallons a minute. They've been practising up a good while at it, including a series of tests last summer in which the stunt was pulled at 11 A. M every day for a month to show it was possible in any

sort of flying weather. This summer tankers converted from Harrow bombers will nurse the boats in Ireland and Newfoundland on a mail-only schedule starting with weekly flights around June first. As it stands now the super-Empire boats will probably go south for the winter taking on the projected British Africa-Brazil run.

Performance data on the big 32-ton G-class boats which Short Bros. are due to launch any day shows that the British won't be ready for real passenger traffic for a long time. With a still-air range of 3200 miles and a cruising speed of 180 mph, their payload is under 2 tons. A five-man crew is another sign that they're intended for mail-only flights not much beyond the survey stage. If the British have any big boats very far along even on paper that are fit for running a real transatlantic line, they're keeping awfully quiet about them. The lack of anything in sight has started stories that they're counting on using some of the big landplanes ordered by the Air Ministry and due in 1940, but this is officially denied.

The French position is just the other way around. They're coming along slowly on some super-big boats to be ready in 1940 or 1941, but as far as this year is concerned, even the French don't deny that their efforts will be to keep their foot in the door with survey flights and not to run an airline. The ancient Lt. de Vaisseau Paris has been supplied with monkey glands by changing Hispano 12Y37 engines, which give it about 5800 hp. The French hope that with all this power it can struggle off at 42 tons and get across with some mail. Three Farman landplanes with pressure cabins will also help keep the tricolor flying.



Pix Photos

THE BRITISH DO LEARN. The above all-steel work-stand for the Ensign is as up to date as the best Pan American apparatus—which apparently inspired it

OR DO THEY? Photo shows one of the "tankers" Imperial will use to refuel their trans-Atlantic boats, going aboard ship for the Hattie's Camp Base, Newfoundland

AS OTHERS FLY IT

Guba to Survey Backway Route

The long way around may sometimes be best, and for some time the British have had their eyes on a reserve nearly-all-British route to Australia across the Indian Ocean from Africa, dodging the Near East and India as possible trouble spots. They've finally got around to doing something about it; Australia has chartered Dr. Archbold's Consolidated boat Guba to survey the route this summer. It will go from Australia to Kenya via the Cocos, Chagos, and Seychelles islands, a total of 4,000 miles.

A famous aviation partnership has been broken up by the death of Jacques Breguet, who since their first helicopter in 1908 had been associated with his brother Louis. The Breguet company, which kept its Villacoublay works after its other plants had been nationalized, has just taken over the Latecoere company on the retirement because of illness of another French pioneer, Pierre Latecoere.

A sorting of CAGs is to come soon in England—something like it has been expected ever since the Civil Air Guard scheme got underway. One of the most justified bricks thrown at it was that it would produce a mob of half trained pilots who would be less use in an emergency than a smaller number with more experience. Now that 3,800 are in training, the Air Ministry has decided to select the CAGs most likely to fit into the R.A.F. in case of war and give them advanced training, while the rest "will be encouraged to undertake other forms of National Service." At that, the shotgun nature of the plan in offering instruction to everyone who wasn't halt, lame, or blind has turned up some likely R.A.F. material that hadn't been uncovered by previous drives.

The absolute speed record is in for a tough summer if the English and French get anywhere with the ships they are building to give it a beating. Lord Nuffield is angeling one expected to do 530 mph—about all that's known on it is that it will have a Napier engine, probably the new high power one of which there have been rumors for some time. In France Delmotte, an old hand at record tries, will use the medium engine, little ship formula—a Caudron racer with an 800 hp Renault engine. The ship is a sort of cousin to the Caudron Cyclone light fighter, as both are derived from the Caudron C-712 built for a record attempt in 1937.

Prize bomber this month is the Junkers that did 621 miles at 321 mph with 4410 pounds, 25 mph over the Italian record. It's a prototype not yet in production, with two 1,100 hp Junkers Jumo 211 direct-injection engines. The cooling system is unconventional—at first sight the nacelles look as if they contained radials, as the radiators lie around the nose of the engines, covered by round cowlings with gills to the rear.

The Cavalier accident report, clearing the Captain and crew of any save the shrewdest of judgment in continuing their flight after bad weather loomed up, has been pretty well taken at its face value in England—as it perhaps should be. American criticism of the incident is discounted as Yankee jealousy of Imperial.

Have you heard about "Chinese dispatching?" Like all those old "Chinese landing" and "Chinese Immelman" expressions that grew up in the post-War flying schools, this one denotes the direct opposite of ordinary practice. It seems that in War torn China, especially after the Japanese shot down one China National transport and a couple of Eurasia planes, it dawned on the officials in charge of dispatching that a good clear day was the worst possible condition for a flight which expected to reach its objective. So now they don't give their pilots the highball sign unless the ceilings are plenty low and the visibility very limited indeed. Want a piloting job?

AVIATION PEOPLE

International

HAPPY LANDINGS! Lieut. Commander R. P. McConnell (right) U.S.N. gives best wishes to Lieut. Commander Humberto Gal-Lino of the Peruvian air force, as the latter prepared to take-off from Miami in command of three new Grumman amphibians en route to Peru. His flight was brilliantly successful.

OUR DEEPEST GRATITUDE! For their effective relief service after earthquakes struck Chile in January, that government decorated nine Panagra men with the "Order of Merit". Above Operations Manager T. J. Kirkland is congratulated on his award by Chilean Minister of Foreign Relations Sr. Abraham Ortega.

MANAGER: J. Stanley Smithson, project engineer for Douglas on nine military models, and since 1934 an engineer for North American Aviation, has been made Factory manager for that very busy company.

REPRESENTS GOODYEAR. Karl J. Kernochen has been appointed manager of aeronautical sales on the West Coast for Goodyear Tire & Rubber Co. He has been a salesman for Goodyear since 1917.

JOINS C-W. Dean Smith, veteran pilot for American Air lines, once pilot for Admiral Byrd, has joined Curtiss-Wright's St. Louis Division as Director of Sales. First job—to market the new C-W—20 transport.

ELECTED DIRECTOR. A. T. Colwell in charge of Thompson Products engineering since 1930, and vice president since 1937, has been made a director of that corporation. A West Point graduate, he is a member of the S. A. E.'s national council.

SPECIAL. Kay Purdy, after several years with United, has joined E. K. Smith's Airline Ticket Agency as Special Representative.

Wide World

RESTLESS. Laura Ingalls wants more records. Last month she announced she would shoot at the solo distance record in her new Barkley-Grow.

Wide World

TWO FIRST LADIES: Mrs. Franklin D. Roosevelt (did you read her excellent piece on flying in Colliers?) chats with United's Clara Johnson. The Johnson has over 2,000,000 miles in her log book and has celebrated her eighth anniversary as an air line stewardess.

WITH DEEPEST SORROW, we report the death of our good friend Peter Guilonard, late Assistant Managing Director of KLM. He was truly an outstanding leader in world air transport.

BRIGHT YOUNG MEN. Hamilton Standard Propellers, division of United Aircraft, has appointed John L. Brown, Jr. (above left), Assistant Factory Manager; Samuel P. Crago (above right), Assistant Sales Manager; Carl F. Baker (below left), Assistant Chief Engineer, and H. M. (Hoot) Ellis (below right), Sales Representative on the West Coast. Brown, a graduate of Harvard College and Business School, has been with United since 1928.

Crago, a graduate of Carnegie Tech and former Marine pilot has until recently flown for Pan American Airways. Baker graduated from M.I.T. and the Air Corps' Training Center, has been with United for six years. Ellis, former Yale football player of considerable note, also graduated from the Boeing School, has been with the propeller division for three and a half years. All the appointment took effect as of April 1.

DIRECTOR. Dorothy Ceraty, after five years of air line and newspaper work, has been appointed Director of the Women's Division of United at Chicago.

CHIEF HOSTESS. Willie Peck, 23, an honor graduate of two colleges and a once professional dancer, has been named to that post by Braniff.

Martin Adds A Wing

Doubles plant capacity in 11-week project

By the time this issue reaches our readers it is probable that the Glenn L. Martin Company will be busy producing aircraft in its huge new sub-assembly building erected almost by magic in a bare 11 weeks' time. Actually the story of this plant addition is one of those old fashioned dramas featuring the American genius for high speed organization and output No longer ago than February 2 Glenn Martin called up Architect Albert Kahn in Detroit, "We have just decided to double our plant capacity. We want the whole thing completed by April 24. Can you be here tomorrow?". The next day Kahn arrived in Baltimore with a small staff. The day after that a contract for some 22,000 tons of structural steel had already been forwarded to Pittsburgh. Two days later (it was, after all, a week-end) a Washington contractor started the job of excavating 70,000 cubic feet of earth in 13 days. And so it went. A railroad spur appeared overnight. A mountain of materials came pouring in days ahead of an almost incredibly severe delivery schedule. Soon the big 240,000 foot expanse of concrete floor on the first deck was ready A fleet of traveling cranes moved back and forth erecting big steel trusses. Some 2,000 men by this time were working day and night, building walls and partitions, fitting windows, doing the 101 detailed jobs that go into the creation of an ultra modern factory building.

Meanwhile in the adjacent field a 320-acre heart-shaped plain is being cut out of the scrubby woods that cover most of the company's 1,200 acre property. As this is cleared and stumps are grubbed out by tractors, other tractors move in to move some half million cubic yards that must be shifted before the new airport is finished By June 1st the field will get its first 4,000 ft runway. A second is due to be finished July 15, a third on September 1st.

When the entire construction program is finished, the Glenn L Martin Company will have a complete and super-modern factory with a total floor area of 1,097,000 square ft. with employment facilities for 10,000 workers. Already the total number of employees on the Martin payroll has gained 53 per cent since January 3 to reach a new high level of 5,544, making Martin the second largest employer of labor in the City of Baltimore. By the end of the current year, President Martin estimates that the 10,000 figure will be closely approached The company now has a backlog of unfilled orders in excess of $33,000,000 The most spectacular recent order on the company's books was one for 100 of its new twin-engine bombers placed by the French Government.

At a recent meeting, the following officers were elected for the current year: Glenn L. Martin, president, J. T. Hartson, executive vice president; H. F. Vollmer and B. C. Boulton, vice presidents; Thomas H Jones, secretary; M. G Shook, treasurer and assistant secretary; M R. Schermerhorn, assistant treasurer All of the officers, with the exception of Mr Schermerhorn, were re-elected as directors, as well as Howard Bruce, John W. Castles, and W. A. Cranning.

Lockheed Climbing

Payroll at 5,300; new models planned

EMPLOYMENT figures at the Lockheed Aircraft Corp plant have been shooting up this year like the mercury in a Los Angeles thermometer on a midsummer day. Latest check we had showed in the neighborhood of 5300 employees on the payroll, an all time high for the Burbank plant, and comparing with 3,000 as of January 1. Meanwhile the delivery tempo steps up and the British bombers are rolling out just about on schedule, along with other planes for the Dutch East Indies, and miscellaneous airlines and other customers. Current transport deliveries include a "14" for Poland, and an "Electra" for Aeroput, Jugoslavia.

In his annual report to stockholders, issued March 21, Robert E Gross, president, listed 1938 sales at $10,274,503, nearly double 1937 sales of $5,209,985. For the fiscal year ended Dec 31, 1938, net profits were $442,111 Gross predicted that Lockheed would reach the highest production rate in its history within a few more months. No confirmation has been issued of rumors that Army orders will be placed for the XP-38 type which recently made a sensational transcontinental flight. Gross indicated that the Lockheed Company is rushing engineering work on a four engined air liner of medium size and high speed, to be known tentatively as the "Excalibur".

United Expands

Names officers for new Vought-Sikorsky Div.

MORE details of United Aircraft Corporation's expansion plans (AVIATION, March 1939, p 75) indicate that much of the new construction will be devoted to expansion of engineering and laboratory facilities. To the Pratt & Whitney plant in East Hartford will be added a third floor, with a floor area of about 14,250 sq. ft. This will be of brick and steel construction with improved lighting, an acoustically treated ceiling, and a ventil-

MARTIN'S MASTERPIECE. As we went to press, this was the most recent available view of the Glenn L. Martin factory and its huge new addition, seen rising in the foreground. By the time you see it it will be as obsolete as tri-planes. As shown here, the new "sub-assembly" unit will have two floors, each 240 000 sq. ft. in area. With $35,000,000 worth of unfilled orders on its books, Martin will be able to use every foot of it.

ating system. To the rear of the factory will be erected a new engine test house with four test chambers capable of testing engines up to 3,000 hp. Two new buildings will be used for experimental dynamometer testing of engines and for a new procedure of carburetor testing. Half the floor space of the Hamilton Standard factory, into which the Pratt & Whitney division will expand, will be occupied by an experimental machine shop and assembly department, and a chemical and physical testing laboratory. Two additions will be made to the Hamilton Standard Propellers division, which will move into the former Chance Vought plant, to add about 10,000 sq. ft. to the plant area. Hamilton Standard will also construct its own propeller test house, with four test chambers, accommodating propellers up to 24 feet. The Bridgeport plant, which will house the Chance Vought and Sikorsky divisions, will have the area of its engineering building increased by 4,000 sq. ft., and an addition made to the north side of the factory building of 450 x 150 feet. A roadway will be constructed from the plant to Mollison Airport. The entire program is scheduled for completion by July 1.

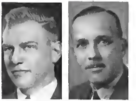
Effective April 1 the two plane manufacturing divisions were consolidated into a single unit known as Vought-Sikorsky Aircraft.

Rensselaer W. Clark, Vice-President of United Aircraft Corporation, is General Manager of the new Vaught-Sikorsky Aircraft division. Other divisional executives are as follows: Charles J. McCarthy, Assistant General Manager; Igor I. Sikorsky, Engineering Manager; Fred Bettiger, Superintendent; Ernest W. Diebman, Sales Manager; Rex B. Beisel, Chief Engineer; Michael Gluhareff, Chief of Design and Aerodynamics; Serge Gluhareff, Executive Engineer; E. H. Glaetth, Asst. Treasurer, Asst. Secretary and Division Accountant; H. F. Conover, Asst. Secretary and Auditor.

Howard to Build

Chicago plant to have plane-a-day output

B. D. De Weese, vice-pres. and general manager of Howard Aircraft Corporation, announced that a $200,000 plant, with an annual capacity of approximately 350 planes valued at about $5,500,000, will be built in Chicago. Negotiations are under way by which the plant will be erected by other interests and leased to Howard for a long term of years. Howard's present production is about four personal transport planes a month, but in its new plant an initial capacity of one plane of this type every working day is anticipated, and one cargo carrier every week. The present payroll of 75 persons is expected to be in-



JOIN C. OF C.—Robert W. Ayer (left), in aviation for thirteen years—with Granville Brothers, Stinson, the B.A.C.—and latterly Chief of the Flight Branch for the C.A.A., has joined the Aeronautical Chamber of Commerce to manage its Technical and Engineering Department. Irving H. Taylor (right) active in exports for sixteen years, and Chief of the Automotive Trades Division of the Dept. of Commerce since 1934, will head the Chamber's Foreign Trade Department.

creased to about 750 in the next three or four months The plant will be 550 feet long and 120 feet wide The company hopes to secure a share of government business Two of the four planes delivered in March went to Jose Iturbi and to the president of the Chicago & Southern Airlines at St. Louis Ben O Howard, president, is on leave of absence as flight research engineer for United Air Lines, and will start on a demonstration tour of the DC-4 as co-pilot with Carl Cover, chief test pilot of Douglas

Northrop Will Build Plant at Long Beach

FORMATION of the Northrop Aircraft, Inc., brings actively back into the aviation industry one of its most colorful designers, John K Northrop LaMotte T Cohu will serve as general manager, Gage Irving will be assistant manager in charge of production; Eddie Bellande has been placed in charge of foreign sales in the Orient, and Raymond S Madison, formerly secretary-treasurer of Consolidated, will act as treasurer.

A twenty-acre site on Long Beach Municipal Airport has been leased for erection of a 100,000 sq ft factory building Present plans are said to embrace the manufacture of small military planes.

Ryan Backlog Up

RYAN unfilled orders continue to soar. A recent $200,000 order for sheet metal accessories for Lockheed Aircraft Corp., puts the Ryan backlog up past the $750,000 mark, highest in history of the firm. Expansion of production has brought several personnel changes Fred H Rohr, formerly factory superintendent, has been made factory manager. E M Lacey has been named factory superintendent. O R McNeel advances to ass't sup't in charge of experimental and service departments. John W Sharp, formerly with the Douglas Aircraft Company, has been named to head the Ryan exhaust manifold engineering department.

Aeroncas to Africa

EIGHT new Aeronca "Chiefs" have been shipped to South Africa to be used in the largest government subsidized flying school in South Africa. The order was placed [illegible] Aviation Equipment [illegible] Export, Inc of New York, export agents for Aeroncas. Equipment included dual ignition Continental 50 hp engines, specially designed carburator air cleaners individual safety belts, and altitude controls Prior to this shipment Aeroncas had been [illegible] erating at flying scho[illegible] Pretoria, Capt Town, [illegible] Elizabeth and Johanne[illegible]

Dorrler Joins Kellett

KELLETT AUTOGIRO CORPORATION announces that Phil Dorrler has become associated with its aircraft parts and subcontracts division, as traveling sales representative. Dorrler, who holds a commercial pilot rating, was for the past four years with Seversky Aircraft Corporation. He will contact manufacturers in all states east of the Mississippi

Curtiss Delivers First SBC-4 Bombers

LATE in March Curtiss-Wright Corporation delivered to the U S Navy the first of a large production order of the new Curtiss SBC-4 Dive-Bomber for service aboard the aircraft carriers of America's scouting and battle fleets The SBC-4 is an all metal, two-place biplane of monocoque construction, powered with a 1,000 hp Wright Cyclone, equipped with completely retractable landing gear and tail wheel, and an automatically-functioning hydraulic system which operates both landing gear and flaps.

Chemidlin Recovers

CAPT PAUL CHEMIDLIN, French Air Ministry observer who was the focal point of a recent international aerial-political upheaval, flew out of Los Angeles on March 31, bound for home after having almost completely recovered in little more than a month from a crash where his life was miraculously preserved For it was Chemidlin who was flying as observer in the Douglas experimental bomber that mysteriously crashed out of control at Los Angeles Airport last January 23 The Douglas bomber was reported as sensationally fast and remarkably good from every angle Cause of the crash has never been revealed officially. But France has ordered 100 of the same type.

ENGINEERING

New Sperry Lab

Bassett heads radio unit West Coast

[illegible] GYROSCOPE COMPANY has [illegible]ened a new radio re[illegible] laboratory at Palo Alto, Calif., near Stanford University, to facilitate the development of the klystron tube, and to carry out the engineering applications of the tube in the aviation field. The new laboratory is under the direction of P R Bassett, vice-president and chief engineer of the Sperry Company, and experiments are being carried out under the collaborative program of the Civil Aeronautics Authority with M I T, the U S Army, and the Sperry Company.

Vega Tests Landing Gear in Special Rig

SUPPLEMENTING tests made late last year on a new type level landing gear for installation in the Vega Starliner, the Vega Airplane Company has recently conducted extensive tests on the hydraulic system which operates the landing gear retracting mechanism, and the wing flaps From a control platform on top of a huge metal frame, more than 1000 take-offs and landings were simulated Average time for retraction of the rear wheels was 6 seconds and for the front wheel, 3 seconds One of the features perfected by Vega engineers is a "shimmy damper" on the free-swiveling front wheel The first Vega plane is to be test flown late in May or early in June, according to present production schedules Five Vegas are coming through the factory at the present time and production will be stepped up sharply upon completion of flight testing.

Consolidated Design Rights to Brewster

BREWSTER AERONAUTICAL CORPORATION and Consolidated Aircraft Corporation have signed an agreement whereby Brewster will acquire all the design rights, design information, jigs and fixtures on nine types of Army and Navy training and observation planes manufactured heretofore by Consolidated. The agreement provides for similar rights on the Fleet basic trainer and commercial airplane, and the rights cover the manufacture and sales of the planes in the United States for both military and commercial purposes. The acquisition of the rights places Brewster definitely in the training plane field

NORTH AMERICAN: Raymond Rice has been named Chief Engineer of North American Aviation Starting with the Materiel Division as Junior Engineer, he moved to the structures section of Glenn L. Martin, joined North American in 1935. As Assistant Chief he directed design of the NA-40.

RYAN: John W. Sharp has joined the Ryan Aeronautical Company as head of its exhaust manifold department. A graduate of Cal Tech and the Ryan School, Sharp has for the past four years specialized in his field of engineering as a member of Douglas Power Plant Section.

FINANCE

Chicago Group Buys Barkley-Grow Aircraft

THE General American Transportation company of Chicago has secured control of the Barkley-Grow Aircraft Corporation, Detroit, which manufactures an 8-10 place twin-engined, all-metal monoplane. The company has been manufacturing ships for Canadian Car & Foundry Company, their Canadian agents, and the first of several ships on order has been placed in the service of the Yukon Southern Air Transport, Ltd., of Alberta. George C Moseley has been elected president and acts as a director with Raymond C Pierce and Sam Laud, representing the new controlling interest. Thomas C. Hayes will act as secretary-treasurer for the Barkley-Grow organization. Other directors are Glenn C Coulter, Robert P. Nessler and Robert R. Stoetzer. It is anticipated that the financial assistance secured through this arrangement will enhance Barkley-Grow's position to approach both the domestic and foreign markets, and it is understood that a program of considerable scope is now in process of development. As a first move, Jack Whitaker is making a tour of the country gathering data on the potentialities of the feeder air line market.

Russel Heads National

FRANK F. RUSSELL has been elected president of National Aviation Corporation, to succeed Edward O McDonnell, who has been made chairman of the board. S F Christy becomes secretary and assistant treasurer.

Fairchild Registers

BOTH Fairchild Aviation Corporation and Fairchild Engine & Airplane Corporation file registration statements with SEC. The former (holding company for Fairchild subsidiaries) estimates a return of about $650,000 from 40,000 shares at $1 par value common $100,000 would be used to retire a note of *Fairchild Aerial Camera Corp.*, part for working capital, and part to reimburse the company's treasury. The Fairchild Engine & Airplane Corporation's statement covered 8,000 shares of $6 convertible preferred, and an undetermined amount of common stock to be reserved for conversion. 7,700 shares are to be offered publicly. Proceeds will be used to repay bank loans of Ranger Engineering Corp., repayment of additional bank loans, purchase of equipment, and working capital.

Harlow Files With SEC

REGISTRATION statement covering 500,000 shares of $1 par value capital stock has been filed with the SEC by Harlow Aircraft Co of Alhambra, Calif. 250,000 shares will be offered to the public at $1 per share, and of the remaining shares 225,000 will be used in exchange for the assets of Harlow Engineering Corp., the predecessor company, and 8,333 shares each will be offered to H F Keenan, W. P. White, and R. F. Givsen at $1 per share. Proceeds will be used for purchase of assets of the predecessor corporation, payment of predecessor's debt, and for equipment, plant and working capital.

Solar Adds Dividend

WITH Solar Aircraft Company sales records continuing at record high levels, and with net income showing proportionate gains, the directors of Solar Aircraft Co, San Diego, have voted an additional dividend of five cents a share on the common stock of record April 1, last, bringing total dividend disbursements during the fiscal year ending April 20, last, to 20 cents a share. Additional factory space will be provided early in May when additions to the main plant—now under construction—are completed to more than double previous production space.

Breeze Names Officers

OFFICERS elected at the annual stockholders' meeting of Breeze Corporations, Newark, were J. J. Mascuch, president; E. L. Beh, A. L. Johnston, Jr., J. F. Lucas, and J. W. Young, vice-presidents; J. T. Mascuch, secretary and vice-president, and H. L. Bolton, treasurer. These officers also serve as directors.

Management Unchanged

BORG-WARNER CORPORATION, manufacturer of automotive, agricultural, and household appliances, has acquired the Pump Engineering Service Corporation of Cleveland, Ohio, and now operates this concern as a subsidiary, according to an announcement by Charles S Davis, Borg-Warner president. The Cleveland company has been for several years one of the country's outstanding manufacturers of aviation pumps and parts, known by the trade name of Pesco. The present organization will continue to operate the business, making the same products at the same place, but will probably expand their engineering and new products somewhat. Present officers are William S Jack, president, and J. P. Johnson, vice president and chief engineer.

» AIRCRAFT PRECISION PRODUCTS, INC., reports consolidated net profits for the period from the date of establishment of the company on Feb. 7, 1938, through Dec 31, 1938, of $6,500 38, equal to 17 cents a share on the 38,000 shares of outstanding stock.

» The Aviation Corporation and Subsidiaries, for fiscal year ending Nov. 30, 1938, consolidated net profit of $187,309, after deduction of $57,000 for taxes. Compares with net loss of $437,327 for previous year. Net sales of manufactured products amounted to $6,373,762, against $3,987,362 for previous fiscal year. During the year The Aviation Corporation acquired the minority interest in Aviation Manufacturing Corporation which thereby became a wholly-owned subsidiary. Also during the year the Stinson Aircraft Corporation was liquidated and its assets and trade name acquired by Aviation Manufacturing Corporation.

» Bendix Aviation Corp., for the first quarter of 1939, net profit of approximately $1,000,000, equal to 50c a share on 2,097,863 shares. Contrast with loss of $581,805 in like quarter for 1938. Net sales for first quarter were off 5 per cent from preceding quarter, but 36 per cent above sales for the first quarter of 1938.

» Brewster Aeronautical Corp., for the year ending Dec 31, 1938, net income of $233,878 or 66 cents each on 350,000 common shares of $1 par value. Compares with net earnings of $19,327 or 5½c a share for period starting Feb 10, 1937 to Dec 31, 1937. Net sales in 1938 were $1,490,338 against $712,823 for preceding period, net orders in 1938, $2,208,406 against $914,795 in preceding period. Unfilled orders on Mar 31, 1939 stood at record figure of $2,381,413.

» Cub Aircraft Corp., Ltd. for six months to Feb. 28, 1939, net operating profit of $2,311; sales for period totaled $26,744.

» Fairchild Aviation Corp. and Subsidiaries, for year ending Dec 31, 1938, net income of $322,473, equal to 95c each on 337,032 shares of common stock. Compares with net of $139,674 or 41c. a share for 1937. Net sales totaled $2,195,817; unfilled orders, $1,070,338 at the end of 1938.

» Fairchild Engine & Airplane Corp., for year ending Dec. 31, 1938 net loss of $185,229 against net loss of $352,068 for 1937.

» Glenn L. Martin Co. for first quarter of 1939, net profit of $682,497, equal to 62½c. per share on 1,092,308 shares outstanding. Compares with net of $628,563 or 72c each on 877,458 shares for same period in 1938. Net sales for the period aggregated $3,540,511 against $4,300,711 in 1938. Backlog was $39,137,738 as of March 31, 1939.

» Pennsylvania-Central Airlines Corp., for year ending Dec. 31, 1938, net loss of $20,867, against loss of $159,311 in 1937. Total operating revenues were $1,450,593 against $1,185,510 for 1937. Current assets on Dec. 31, 1938, $301,658, liabilities, $156,555; against $195,051 and $128,542 respectively at end of 1937.

» Solar Manufacturing Corp., for year ending Dec 31, 1938, net loss of $25,014 against net profit for 1937 of $61,001 or 27c. on 225,000 capital shares.

» Sperry Corp., for year ending Dec. 31, 1938, net income of $4,991,398, equal to $2.48 each on 2,015,565 shares of $1 par capital stock. Compares with net income of $2,949,880 or $1.46 a share for 1937. Dividends in 1938 totaled $1.80 a share, against $1.20 a share in 1937. Current assets at end of 1938, $12,825,217; liabilities, $4,581,598.

» Wright Aeronautical Corp. for year ending Dec 31, 1938, consolidated net profit of $3,288,772, equal to $5.49 each on 598,857 no-par shares of capital stock. Compares with net of $2,090,192 or $3.48 a share earned in 1937. Current assets for the 1938 period, $8,320,238; liabilities, $4,123,518. Capital surplus at close of 1938, $1,540,806; earned surplus, $5,614,554.

First Rate Decision

CAA boosts Mid-Continent to 38 cents a mile

"JUST what is the C.A.A. going to do about airmail rates?" For at least eight months no question has been more common or more important to the American air transport industry. There are other interesting questions of policy the C.A.A. must settle—squabbles over routes, demands for new methods for determining mail payments, requests for thousands of miles of extensions and feeders. There are other current knotty problems the lines must work out on their own—matters of competition, equipment, advertising. But none of these are half so vital as the query, "Will the C.A.A. be generous and constructive or stingy and hardboiled when it gets right down to fixing airline income?"

April 17th, the industry got a pretty complete answer. In the first airmail rate decision it had ever handed down, the C.A.A. announced that it had granted an increase to Mid-Continent Airlines, Inc., from 33¼ cents per airplane mile with loads of 300 pounds or less to 38 cents. Mid-Continent's former supplementary rate of 10% additional payment for each 100 pounds or fraction thereof was changed to 2½% additional for each 25 pounds of excess. In spite of the fact that the airline had asked for 40 cents per mile, the fact that this all important first decision resulted in the granting of a substantial rate increase is tremendously encouraging. Even more constructive are some of the statements of policy which accompanied the decision.

In the C.A.A.'s opinion, the Civil Aeronautics Act gives it a broad discretionary power to fix rates which are not only fairly compensatory but which also assure the stable economic development of the carrier—to meet the needs not only of the foreign and domestic commerce and the postal service of the United States, but also the needs of the national defense.

In the C.A.A.'s opinion, the Act directs it to administer the rate-making provisions "in such a manner as to expedite and not retard the attainment of air carriers of an economically sound and stable condition. As that objective is approached there will naturally be an accompanying reduction of the dependence of air carriers upon airmail revenue and a progressive decrease in the rate of airmail compensation to be paid by the government. Such an administration of the Act, must of necessity, involve a policy of rate determination which will serve to recognize managerial efficiency and to permit benefit therefrom to redound to the carriers, thus providing an incentive to management for further development."

Safety

Lines get council awards; records best ever

LAST MONTH was safety month on U.S. air lines. For one thing the National Safety Council made its annual awards to the lines with the best records. And they found some very worthy recipients to present them to.

Among companies flying more than 30,000,000 passenger-miles a year, American Airlines stood first with a 3-year record of 410,237,962 passenger-miles without a single fatality. Eastern Air Lines, with only one fatal accident on its 10-year record, won a certificate of commendation in the same category.

Among companies flying between 2,000,000 and 30,000,000 passenger-miles a year, Pennsylvania-Central Airlines had the best record, "70,159,468 passenger-miles without a passenger or crew fatality for a period of approximately 11 years." Braniff Airways was judged next in merit for a clear record of 47,256,589 passenger-miles 1932-1938 inclusive. An accident at Oklahoma City on March 27 ended Braniff's clear record, but did not affect its award, based on performance up to January 1, 1939.

Among lines flying less than 2,000,000 passenger-miles per year, Continental Air Lines and Inland Air Lines, won certificates for clear records.

Besides these regular awards, special certificates of commendation were presented to the Eastern Division of TWA for a record of 181,204,504 passenger-miles without a fatality and to United Air Lines for "conspicuous technical advancement of the safety of air transportation"—more specifically for work in developing anti-static radio devices, the Terrain Clearance Indicator, and its blind landing technique.

So much for the formal safety awards. A few days later the Civil Aeronautics Authority released statistics to the effect that the Nation's domestic airlines had just passed through the safest winter season in their history. Between December 21, 1938 and March 20, 1939 the lines flew 64,081,025 passenger-miles for each passenger fatality. In fact, during that period in which the lines flew 17,893,270 airplane miles, there was but one fatal accident. TWA, United, American and Eastern, according to the release, flew during this winter period without so much as a single forced landing.

Simultaneously with these winter statistics, the CAA announced that for the whole of 1938 the combined domestic lines had flown 22,308,771 passenger-miles per passenger fatality compared with 11,915,076 in 1937.

Edward J. Noble, retiring chairman of the CAA, laid much of the credit for the improved safety to the increased efficiency of governmental regulations.

Trans-Atlantic

American Export ready to start surveys

AMERICAN EXPORT AIRLINES has been quietly making a great deal of progress on its program looking toward the establishment of a transatlantic airline. Last month, with a commercial version of the Consolidated patrol bomber already delivered, it announced that it would dispatch its first survey flight "within the next few weeks" over the direct route from New York to Horta in the Azores thence to Biscarrosse, France's air base near Bordeaux thence to Marseilles. The survey ship would be in command of P. J. Byrne, loaned to the line by the U.S. Navy. T. S. Terrill will be first officer, co-pilot and co-navigator. M. C. J. Doyle will be second officer and engineer. W. W. Elmer will be third officer and radio operator. R. B. Carlson will serve as fourth officer and assistant engineer.

The officers of American Export Airlines are W. H. Coverdale, president, John E. Slater, Executive Vice President; James M. Eaton, Vice President, H. M. Gillespi, Secretary and Treasurer, and D. G. Richardson, operations manager. Dr. Jerome C. Hunsaker, head of the Department of Aero Eng. at M. I. T., is aeronautical consultant. The directors of the airline are W. H. Coverdale, John E. Slater, Thomas Hitchcock, Jr., Joseph A. Thomas, Roland Palmedo and Chas. U. Bay.

The Civil Aeronautics Authority has disapproved a contract agreement filed with it by Pan American Airways and American Export Airlines, under which these two companies proposed to operate trans-Atlantic services. By its terms Pan American agreed to recognize American Export's priority in the Mediterranean, American Export recognized Pan American priority on the route north through England; routes to intermediate zones were to be worked out on a flight by flight basis.

L. A. To Vote On Bonds For City Airport

LOS ANGELES, which has attracted the world's greatest aviation manufacturing concentration, has so far not been able to boast a first class airport of its own. The one city landing field, at Inglewood, has remained relatively unimproved. But on May 2 the voters will decide whether or not to provide $3,000,000 with which to build runways and buildings which will bring all airlines operating out of this area to Los Angeles Airport. The bond issue drive was officially launched on April 3rd by a speech given by Col. Richard Barnitz before the Los Angeles Realty Board and massed representatives of the local aviation industry. The money, if voted, will be spent $1,000,000 for hangars, $750,000 for administration and terminal buildings, $750,00 for runways and field improvements, $100,000 for lighting, 100,000 for utilities; and $200,000 for architectural and building costs. All of the airlines operating out of Los Angeles, and all other local aviation interests are supporting the bond issue.

GAINS ALTITUDE. Capt. Otis S. Bryan, graduate of Indiana U. and the Training Center, ten year veteran, has been made Chief Pilot of TWA.

Trans-Canada Cleared Across Maine

ON APRIL 7, the CAA advised the Secretary of State that it had approved the application of Trans-Canada Air Lines to fly non-stop 144 miles across the State of Maine, in the course of its scheduled operations between Montreal, P. Q., and Moncton, N. B. The route to be flown is in a direct line between Megantic, P. Q., and Blissville, N. B.

Pan American

Clippers put in busy month on two oceans.

PAN AMERICAN AIRWAYS last month succeeded in making headline news on almost every route in its nearly worldwide system. In the Atlantic its big Boeing-built Yankee Clipper carried out a "final" inspection and shake-down flight. Leaving Baltimore March 26th the ship crossed directly to Horta in the Azores in 17 hours and 32 minutes. From there a leisurely assignment to inspect and help calibrate the radio at the various bases carried the Clipper on to Lisbon (Portugal) Biscarrosse (on the French Coast near Bordeaux), Marseilles, thence to Southampton, and to Foynes (in Ireland). From Ireland it returned to the Azores, thence back to Baltimore in a leisurely headwind crossing of 25 hours which included a long stop at Bermuda. In all 11,117 miles had been covered in 83 hours of flying time. In command of the craft was Captain Harold E. Gray with Captain Arthur E. LaPorte serving as first officer in a double crew of twelve. Nine passengers including airline officials and representatives of the Civil Aeronautics Authority were also on board. Meanwhile the Yankee Clipper's sistership, Atlantic Clipper, was pressed into service on the U. S.-Bermuda run to help carry the heavy homeward bound post Easter traffic. In all it made some nine round trips, some of them with as many as 80 passengers aboard.

On the Pacific two more of the big Boeing boats entered service, one, christened the Clipper, set a new record between California and Hawaii of 15 hours and two minutes. Both it and the Honolulu Clipper aroused tremendous interest clear through to Hongkong and carried record new passenger lists. Their capacity between the mainland and Hawaii is set at a minimum of 32 in additional to some 1200 pounds of mail and express and fuel adequate for 3200 miles.

Strongly reminiscent of the Spring of 1935, Pan American late last month dispatched the cargo steamer North Haven once more on a mid-Pacific colonizing expedition. A week or two earlier United States and Great Britain had formally exchanged notes agreeing to share the sovereignty of Canton Island in the Phoenix group and Secretary of the Interior Ickes had forthwith licensed Pan American to use that island as an air base. Some 1850 miles southwest from Honolulu, Canton is a diamond shaped bit of sand about 9 feet above high tide at its topmost level, but inclosing a lagoon some 9 miles long and 5 miles at its greatest width. The North Haven carries all the weirdly assorted types of gear which she took with her four years ago to set up villages on Midway and Wake Islands: houses, pumps, tanks, tractors, launches, furniture, airplane gear, fuel, etc. Pan American so far indicates that the expedition is solely for the establishment of a base on Canton, presumably to replace the Kingman Reef and Pago Pago bases used on earlier flights to New Zealand. However, West Coast sources indicate the ship will also call at Noumea and New Caledonia for the purposes of setting up bases for a line to Australia.

Far from this distant arena Pan American stepped up its services to Latin America. Specifically a new twice-a-week schedule was set up between Miami and the Canal Zone to replace a former service via Barranquilla, Colombia, thus bringing the Canal Zone to within 20 hours of New York City. At Cristobal the new schedule permits Pan American Grace planes to make ideal connections for their west coast and Trans-Andean services.

THE CONTROL TOWER

by DAN SAYRE

The Clipper's Insides Fail to Thrill

Our personal inspection of the Yankee Clipper resulted in no let-down of the enthusiasm which had been aroused by the preliminary releases. It is just as big and comfortable and spectacular as they have been telling us and its flight deck is as fascinating a place as we would ever care to spend a day moseying around in. Perhaps we were just a little bit disappointed, however, in the restraint of the cabin furnishings. Its all right, possibly, for the designers to have stuck to calm restful shades of tan and green and grey in most of the passenger compartments, but they might have let themselves go a bit in the smoking-dining lounge. Somehow the lounge on a trans-Atlantic Clipper ought to be the spot for the most extreme super-modern decoration anyone could cook up. As it is, we could find you a dozen beer and pretzel bars within walking distance of this office that make the Clipper's lounge seem like a log cabin.

United Air Lines's Bob Neff got us out to Newark last month to get a first-hand demonstration of United's blind landing equipment as they are installing it on their Mainliners. Chief Pilot Freng was at the controls of the little white-tailed laboratory ship as we swung around the field. Just to make us feel confident, Freng and his co-pilot blotted out all of the wind-shield area in the control room save the top few inches. Freng remained ducked down behind it while the co-pilot occasionally peered out over the top. The thing worked of course as it always has during some thousand landings United has made with it at Burbank and Oakland and elsewhere. But we are not saying we enjoyed it much. It was a very rough day, for one thing. The approach to the field along our glide path seemed cluttered with thousands of tall WPA workers complete with tractors, for another. As a result, when Freng brought the ship in on that low sweeping arc at a speed of about 120 mph, your correspondent tried to fly the ship from the back seat as he never had in years and years of back seat flying. We never properly realized before just how much credit Freng and the other pioneers of instrument landing methods deserved. The men who ate the first oysters aren't in it.

Incidentally, a bouquet of thoroughly dried-out orchids goes to Bob Neff for the month's height of press agentry. We knew that some day, someone would work out the ultimate in those "oldest person in Bumpkin County takes first air trip" gags. But we never expected the one Neff insulted us with. "The oldest person ever to take a ride in an airplane will arrive in New York on April 12", Bob told us. His name is Harwa, who is 2,800 years" ...... Harwa, of course, is an Egyptian mummy.

Stop me if you've heard this one. Or possibly put me straight on it if you know any further details. It seems that a few months ago, the pilot and co-pilot of a transport plane on some airline running through the Southwest had a schedule to fly with no passengers aboard. They did have, however, to cheer their weary way, one of those starry-eyed hostesses fresh out of hostess school, who was "just thrilled to death to get into such a glorious profession." It was incidentally, a very bumpy day. The boys climbed the ship to a good safe altitude, set it on the Sperry automatic pilot, opened the windows as wide as possible, pushed the buzzer button to summon the hostess, then scrammed back to hide in the baggage compartment. When Miss Strugglebump, R. N., opened the office door, to find herself all alone in that great big airplane, the story is, the boys had to apply some of her own smelling salts to get her out of the faint.

Installation of Fairchild-Kruesi Radio Compass in Douglas Transport

Just Published:

PREPARES FOR AVIATION RADIO LICENSE EXAMINATION

Aeronautic Radio

for Operators, Pilots, Mechanics

By MYRON F. EDDY, Lieut., U. S. Navy, Retired, Member Institute of Radio Engineers; Chief Instructor in Aircraft Radio, Stewart Technical School

AERONAUTIC RADIO fills a long-felt need for an up-to-the minute, authoritative guide to principles, selection, installation, operation and maintenance. In preparing this new manual, Mr. Eddy has kept in mind two considerations: First, the requirements of the Federal Communications Commission as to the aviation radio operator's license and the regulations of the Civil Aeronautics Authority as to radio in aeronautics, especially its use by commercial and private pilots. Second, the actual approved usage of existing equipment for both communication and for special purposes such as course guidance and instrument landing.

THE first eleven chapters, if carefully studied should prepare you to pass without difficulty the theoretical part of the examination for an aviation radio operator's license. The next five chapters explain special applications of radio to aeronautics: they include many important new developments such as course guidance and instrument landing. 205 questions enable you to test your grasp of the information given in the book.

The 198 illustrations—photographs, diagrams, and working drawings — will be found an especially helpful feature; they make every explanation furnished in the text clear and easily understood.

WHEN you have thoroughly covered this book you will more quickly acquire practical skill in the operation of radio equipment. You will readily understand manufacturers' instructions for the installation and maintenance of their apparatus.

16 CHAPTERS

Aviation Radio Communications
Fundamentals of Electricity
Radio Electricity
Radio Circuits
Radio Tubes
Batteries
Power Supplies
Radiotelegraph Transmitters
Radio Range Beacons
Radiotelephone Transmitters
Receivers
Direction Finders
Instrument Landing Systems
Radio Traffic Control
Installation of Equipment
Maintenance

502 PAGES, 198 ILLUSTRATIONS, $4.50

(fill in, tear out, and mail)

Sent on 5 Days' Approval

THE RONALD PRESS COMPANY
Dept. M324, 15 East 26th St. New York

Send me a copy of Eddy's new book Aeronautic Radio on approval. Within five days after it reaches me, I will either return it or remit $4.50 plus a few cents for delivery. (We pay delivery when remittance accompanies order, same return privilege.)

Name
(please print to insure correct delivery)

Address

City *State

☐ Employed by
☐ or Reference
(must be filled in unless you remit with order)

Address of Above
* Outside continental U. S. remit $4.75 with order

☐ CHECK HERE if you wish our Catalog of Aeronautic Publications FREE

THE RONALD PRESS COMPANY, Publishers
15 East 26th Street ESTABLISHED 1900 New York, N. Y.

TRAFFIC

1938

Official figures show good gain over 1937

AFTER some delay, the CAA has finally issued operating statistics for the domestic airlines for the twelve months of 1938 as follows:

	1937	1938	Increase
Mi. Flown	66,071,507	69,668,827	5%
Passengers	1,102,707	1,343,427	22%
Pass-Mi.	476,603,165	557,719,268	17%
Express (Ton Mi.)	2,165,078	2,173,206	1%
Mail (Ton Mi.)	6,698,230	7,422,000	11%

Braniff

PASSENGER REVENUES on Braniff Airways during March 1939 were 39 per cent greater than in February, 1939 and 54 per cent better than in March 1938 according to Charles E. Beard, vice president. Revenues during March were the second highest of the Air Line's history, exceeded only by October 1938.

United

UNITED AIR LINES reports an increase during March of 55 per cent in revenue passenger traffic over the figure for February 1939 and a 33 per cent gain over the figure for March 1938.

TWA

TWA REPORTS 6,007,567 passenger-miles flown during March 1939, an increase of 70 per cent over February 1939 and of 44 per cent over March, 1938. Airplane miles flown during March totaled 892,880,—38 per cent over February.

AIR TRANSPORT INDICATOR

April 1, 1939

128.7

Which is the ratio of the pass miles reported by the Air Transport Association for all domestic lines for March 1939 to the figure for March 1938.

Trends for the year continued excellent. For the first three months traffic stood at 109,978,858 pass miles—up 25.2 per cent.

American

REVENUE PASSENGERS carried by American Air lines during the first 24 days of March increased 38.2 per cent over the corresponding period in 1938 according to Charles A. Rheinstrom, vice president. Business increased on all of the system's routes. Chicago-Fort Worth showing the best index of improvement at 66.3 per cent.

Canada

A study of traffic figures for air line operations in Canada shows that air mail poundage has increased from 625,040 pounds in 1934 to 1,857,221 pounds in 1938. In the same period, air freight and express increased from 14,441,179 pounds to 28,387,718 pounds. Since its inauguration, March 1, the Transcontinental Air Mail Service provided by the Trans Canada Air Lines has shown a steady increase in poundage.

Sunnyvale Base

(Continued from page 53)

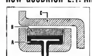
Army base at Sunnyvale, California.

The witnesses supporting testimony was competent and painstaking, if not particularly eloquent. But, as far as both sub-committees went, the answer was completely negative. As a result, the Second Deficiency Appropriation Bill reached the floors of both houses without any funds at all included for the Sunnyvale base, and it was so passed by the House.

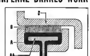
Fortunately, Senator Hiram Johnson of California had become interested in the creation of a research center which would be of such value to California's Aircraft Industry and proposed an amendment to include a direct appropriation of $4,000,000 plus a contract authorization of an additional $6,000,000 for the purpose. Senator Glass of Virginia objected, apparently on the grounds that it might detract from the importance of a Virginia institution. Finally, $4,000,000 was included in the bill to start construction of the Sunnyvale laboratory, with the understanding that the N.A.C.A. would proceed to use it along plans already prepared, anticipating an appropriation of a further $6,000,000 next year. As this issue of Aviation went to press, the bill was about to go to conference between the House and Senate, but seemed likely to remain in the conferees' report and to be ultimately approved by the House.

GOODRICH E.T.* BRAKES WIN WIDE ACCLAIM !

HOW GOODRICH E.T.* AIRPLANE BRAKES WORK



1 Cross sectional view showing the Goodrich E T* Airplane Brake released The Expander Tube (A) is deflated, the sectional brake block (B) retracted, and the wheel (C) free to turn.



2 The Expander Tube (A) is inflated with braking fluid (AA), forcing the sectional brake block (B) against the brake drum (C) bringing the plane to a swift, smooth, safe stop

3 The full circle of sectional brake blocks (B) is joined together by metal retractor springs (BB) When the Expander Tube (A) is inflated these brake blocks press *evenly* against the brake drum (C) all the way around When the Expander Tube deflates, the springs retract, pulling the brake blocks back from the drum and letting the wheel turn free without drag

The New Goodrich

New Expander Tube Construction a Big Step Forward in Landing Safety and Smoothness...

GREAT PROGRESS has been made in airplane braking since the early use of the "skid" to dig into the ground and bring the plane to a slow, jerky stop The Low Pressure airplane tire brought new problems and Goodrich engineers set out to find the solution

After years of study, of development and of testing, both on specially built laboratory equipment and in hundreds of actual flights, Goodrich perfected the Goodrich E T* Brake

Today, half ton sport planes and 33-ton giant transports are making quick, safe smooth landings on the perfect combination of Goodrich E T* Brakes and Goodrich Airplane Silvertowns

Some of the features of Goodrich E T* Airplane Brakes that make them the "preferred equipment" of men who know are these

They are lighter than most types of airplane brakes—they are absolutely controllable and not self energizing

The Goodrich E.T* Airplane Brake is simple and fool proof It consists of only three basic elements—the Expander Tube, the brake block, and the retractor spring. Therefore, there is practically nothing to get out of order or require repairs It automatically compensates for brake lining wear, thus giving much better service at peak efficiency

These points of superiority added together mean just this—Goodrich E T* Airplane Brakes stop quicker, smoother and safer than any other type of airplane brake

For more information about Goodrich E T* Airplane Brakes and Goodrich Airplane Silvertowns write Dept 681 Aeronautical Division of The B. F Goodrich Co., Akron, Ohio

*Expander Tube

MORE THAN ONE MAN'S OPINION

"The combination of Goodrich Silvertowns and Goodrich Brakes increases landing control under all conditions. Planes are decelerated to a smooth, uniform stop" Capt. A. B Duke, Eastern Air Lines

"Our pilots find Goodrich Expander Tube Brakes smooth and reliable They like their flexible control features." J. A Herlihy Vice President in Charge of Operations, United Air Lines.

"We put Goodrich E. T Brakes on Piper Cubs because they are the simplest, lightest smoothest acting hydraulic brakes available today" W T Piper President, Piper Aircraft Corp

"1938 and 1939 Stinson Reliants and the new Stinson 105 use Goodrich E T Brakes We have yet to install any replacement parts in these dependable brakes." W A Mara Vice President The Stinson Aircraft Division, Aviation Manufacturing Corp.

"When I set down my Gulf hawk, I want to know that I can stop quickly smoothly and efficiently That's why I use Goodrich Airplane Silvertowns and Goodrich E T Brakes" Major Alford J Williams, The Gulf Oil Corp

"We like Goodrich E. T Airplane Brakes That they are used to bring the giant 33 ton DC-4 to a quick safe stop is their best testimonial" Carl Cover Vice President Douglas Aircraft Corporation

E.T.* Brakes

SAFER, SMOOTHER STOPS FOR UNITED AIR LINES

In covering its New York—Chicago—California and Seattle—San Diego routes United Air Lines flies 50 000 miles a day A big order for tires and brakes as well as planes! And United meets that responsibility with the latest, most modern combination for landing safety and smoothness—the use of Goodrich Airplane Silvertown Tires and the new Goodrich E.T* Brakes.

WHENEVER YOU FLY, SEE HOW MANY TIMES YOU TAKE OFF ON GOODRICH AIRPLANE SILVERTOWNS

AVIATION OPERATORS CORNER

Bunch Breaks Record

Cuts Transcontinental Light Plane Time to 23 hr., 27 min., 10 sec.

CLARE W. BUNCH took time out from his executive duties recently to fly one of his Monocoupes from Burbank, Calif, to Roosevelt Field breaking the previous transcontinental light plane record He arrived after a flight of 23 hr, 27 min, and 10 sec, at 1 07.10 pm, April 3. The ship was a standard model with 90 hp. Lambert engine and carried 152 gallons of gasoline, 15 of which remained after the landing Overload at take-off was 23 lb. and gross weight, 2390 lb. Estimated cost was $27.50

Following the southwestern route over Albuquerque, Amarillo, St. Louis, and Pittsburgh, Pilot Bunch used T.W.A. radio weather reports en route.

Private Pot Boils

Organizations Contend for Privilege of Fighting Private Flyers Battles

LATEST rumors of war are not from Europe but from the potentially fertile field of private flying. While no one ever seems to know exactly when a war starts, the incident that touched off this particular conflict seems to be the announcement that a group of wealthy sportsmen from Philadelphia were organizing to bear the standard of their fellows in Washington The original group consisted of C. T. Ludington, Larry and Phil Sharpless, Alfred Wolf, and C. Storey Smith. The latter has subsequently resigned from the governing group. Sponsor is Popular Aviation Magazine which agreed to contribute $1000 per month for 24 months for operating expenses, and in turn becomes the official organ of the new organization as yet unnamed. Consultant is Gil Robb Wilson, Director of Aeronautics for New Jersey.

Next move came from the six-year-old Private Fliers Association which has been carrying the ball in Washington but whose resources have been limited because of its stringent membership requirements and small membership. Much of its work has been done through the personal enthusiasm of Secretary W. W. Brinkerhoff, Legal Advisor Haven Page, and President A R Stevenson At an April meeting of its Board of Governors President Stevenson announced a reduction in dues, less stringent membership requirements and a seven point program for the promotion of civil, non-scheduled aviation Among the planks in the platform are Simplification of C A R Reduction of restrictions on private flying Elimination of duplication in local, state, and federal regulations. Support of the C.A.A Civilian Training Program Fair allotment of funds for off line airports Reduction of accidents Opposition to state liability or compulsory insurance laws and other detrimental legislation

Although P.F.A is affiliated with N.A.A. the former feels that its purposes are best served by retaining independence of action and the relationship has not gone much further than the stage of "close cooperation"

Shows of the Season

The Air is Full of Meets and Airport Dedications

Your week-ends at home will be few if you are a private pilot intent on covering all the air meets and airport dedications this spring Here are a few of the shows scheduled so far

As a judge in the beauty contest held last year in connection with the Birmingham Air Carnival, your correspondent can recommend very highly the variety of pulchritude attracted to the "Magic City." It was a tough job to pick the winner An even bigger and better contest is planned for the Ninth Annual Show June 3, 4. Dynamic Steadham Acker is already burning the midnight oil on the build-up and the Birmingham Aero Club is sponsoring the event as usual

Pilot Clare W. Bunch and his record breaking Lambert powered Monocoupe

Canadian pilots are invited to participate in the International Air Show at Erin Airport, Detroit, May 20-21 Arrangements are being made by the Detroit Junior Board of Commerce, sponsors, for free entry to and from Canada for pilots providing they clear from the Walkerville, Ontario, Airport Events announced by Manager Irvin Davis, include spot landing, bomb dropping, and acrobatic contests

Climax at the Cotton Carnival, "the south's greatest party" will be an air show to be staged May 14 at Memphis Municipal Airport. Approved by the CAA as a Class A meet, the Cotton Carnival Air Show will feature such celebrities as Mike Murphy, Squeak Burnett, Art Davis, Don Waters, Clarence McArthur and others A parade of their latest models by a number of aircraft manufacturers will be a feature. Gasoline and oil for the show and for visitors are on the Gulf Oil Corporation

July 4 is the sendoff for the new Madison (Wis.) Municipal Airport and elaborate plans have been made for the dedication Army and Navy participation, a ground show of airplanes and equipment, and a historical transportation parade are features The port is the result of many years of work by Executive Director Jackson and other outstanding citizens and collaboration of the state as well as the city and federal governments

Waters Succeeds Southee

Soarers Plan Tenth Annual Meet for June 24-July 9

EARL SOUTHEE'S successor as General Manager of the Elmira Area Soaring Corporation is Maurice L Waters appointed recently by the Board of Directors of the Corporation whose president is William L McGreth Earl resigned to go to work for the C A A Private Flying Division.

Waters earned his "C" license four years ago and a D of C. rating of Licensed Instructor prior to the 1937 Soaring Contest. Among his duties will be responsibility for the Soaring Area Corporation's part in the Tenth Annual National Soaring Contest scheduled for June 24-July 9 at Elmira.

The 2nd Annual Western Spring Soaring Contest was staged April 8-9 and 15-16 from the Kern-Mesa Soaring Site, about 20 miles southeast of Bakersfield, Calif, and in the fringe of the Tehachapi mountains Sponsored by the Southern California Soaring Society, of which famed Dr Wolfgang B Klemperer is president, the meet had the sanction of the National Aeronautic Association, and drew some twenty soaring planes and fifty soaring pilots on the entry list. All the soarers at the meet were of American design and manufacture

Troy Flyers, Inc., has purchased the equipment and rights of Troy Air Service, Inc, and is now operating at Troy, N Y, airport, according to a recent announcement of Howard W. Pember, president Flight instruction, charter service, sightseeing trips are offered Troy Flyers are distributors for Luscombe and dealers for Rearwin Airplanes.

MANUFACTURER AEROAD

Vice-President Ted Weld, of Piper, is now visiting England, Germany, France, Sweden, and Denmark In Copenhagen he will visit the Piper assembly plant, formerly the old Rohrbeck factory

Thumping the "safety plane" specification an Open Forum staged in Los Angeles April 7th under the sponsorship of the Licensed Airmen of America, brought repeated suggestions that emphasis be placed on safe pilots, rather than safe planes. Approximately one hundred and fifty pilots, engineers, and plane builders, heard Edmund T Allen well known test engineer, plead for more training in stalls Among the other speakers were Waldo Waterman, Douglas Schearer and Vic Peters

A "Cornfield" Flyer Speaks

SCARCELY a day passes but what we receive some communication from the forgotten flyer,—that vast group of young men who have not yet been benefitted by any form of subsidy or encouragement and have had to work out their aeronautical salvation alone But rarely is their case so well stated as in the accompanying letter sent to us without any request that it be published by Mr. R. D McClure of Lodi, Calif The reactions herein expressed are not those of Mr. McClure alone but of a group perhaps larger than any other within or without the industry It is our strong conviction that there is a reservoir of usefulness in this group which should not continue to remain untapped

Mr S Paul Johnston, Editor
Aviation
New York City N Y

Dear Sir

I wonder if you have ever given any thought as to just what type of fellow the average non-commercial and non-military pilot is? He is one that is described in a certain nation wide publication as being "cornfield trained." That is, no doubt, substantially true. He is also one who likes to fly and wants to fly so much that he spends every spare dollar he can scrape together to indulge that desire. In the majority of cases, he eats, thinks, and sleeps in terms of flying His training may have been in a modern plane or in a ten year old "clunk" He is credited with a large percentage of the aviation accidents His age may be any where between seventeen and thirty five.

Suppose the "cornfield" training be admitted It is better training than practising landings on the paved runways of a modern airport. There are many reasons for stating that the "cornfield" pilot should be the best all other points being equal The first and probably most important is that in case of an emergency one is generally not in the vicinity of a modern airport. The second is that there are usually more planes per square foot of available field in the rural airport than there are in the large metropolitan airports, therefore there is greater congestion of the runway and surrounding air space The pilot learning and flying under these conditions has to be alert. The type of plane makes little difference except that one accustomed to flying obsolete types will appreciate the improvements in the later types of planes.

Why should that group of pilots (private-amateur) be credited with so many accidents? There are two major reasons The first obsolete aircraft the second education

Many of the fellows that are unable to afford flying in a modern well maintained plane turn to a substitute—the second third and even fourth hand airplane. It appears to be cheaper to own a plane of this type than it is to purchase time from a fixed base operator That is particularly true in cases where the owner is a mechanic he can make an arrangement with a mechanic to service and maintain the craft In most of these cases the owner pilot attempts to handle this important department himself and while in some cases it works out O K in others the plane eventually reaches the uncertificated condition. The percentage in favor of accidents naturally is higher in this group Wouldn't it be a credit to the pilots and to the industry if through some government agency these pilots could use or possibly own and maintain under proper supervision a modern plane

By education I mean educating the motorists as well as the embryo pilot to respect and observe the regulations Too many reports of accidents to privately flown airplanes state that the pilot was a student with a passenger or has been stunting too close to the ground, or perhaps was not wearing a parachute. Every accident where regulations have been broken is an indication that the instructor has failed He has taught the student to fly but not to fly safely It is common knowledge that instructors and pilots at the small out of the way airport often overlook infractions of the regulations.

The greater majority of students who finally pass the pilot examinations soon let their flying drop There are two major reasons for the loss of these certificates The first is that few fixed base operators have sufficient equipment to allow part of it to leave the airport on a cross country trip for a whole week end The hop over town to show some admiring friend his can fly soon loses its appeal Here again if the prospective private pilot were able to use a plane of his own this condition would materially improve. Also, with more planes flying in private operations the second condition contributing to the loss of certificates by the holders, would automatically correct itself That is a lack of places to go.

The average fellow learns to fly to be able to go places quickly. That is the purpose of the airplane In business and other fast commercial transport the airplane supply the need but the airlines do not and can not supply nor take the place of the needs of the private pilot He wants to fly to his favorite fishing hole beach, or hunting territory Give him a plane and he will demand fields to accommodate him at such places Has it not been so with the motorist?

There is one more point I'd like to mention,—that of selecting all these future pilots from those who are attending college. It hardly seems logical that just because one has or is attending college that he would make a better pilot than one that has only high school credentials to his credit. Surely the mechanic in a garage would be able to understand the functioning of an airplane engine as well as the medical student and the structural steel worker should understand aircraft structures equally well as the law student. There are many able pilots that have never attended either college nor accredited flying schools There are also thousands of youngsters to-day that are building and flying models with remarkable success It wouldn't be fair to these model builders and it is not fair to those that hold private certificates through their own efforts, to deny them the privilege of government subsidy or the right to enter the military air services because they lack a college education.

Personally I am just one of those average fellows I have been flying and working with planes since 1930, more as a hobby than anything else, with perhaps a secret desire to fill some niche in the industry I hold an amateur pilot's certificate as well as an aircraft mechanics ticket My regular occupation is in electrical work, all aviation activities are and have been with slight exceptions spare time interests I am 28 years old. The observations I have made around the local airport and others of similar character are what this letter is based on

Sincerely yours
R D McClure
465 So School Street
Lodi California

TAGGING THE BASES

with LES NEVILLE

A Word to the C.A.A. Student Pilots

Bad weather and late starts have slowed up the C A.A training program, but now it is well under way and the boys are flying fast and furiously to log the necessary number of hours for their private tickets before the schools close for the summer As this is written, more than 200 have soloed. To these and to the solo pilots who follow them we wish to say a word of warning Few accidents occur in dual instruction But past experience shows there is a dangerous period afterward when overconfidence leads us into temptation The C.A.A has recognized this and hopes to combat it through the controlled flight course But in final analysis it is up to you Read and remember the Ten Commandments published on page 19 of this issue, preserve the proper respect for your airplane, and you need have no fear for the danger period through which you are passing

New pilots will be confused when they begin to receive literature from the several private flying organizations now seeking or about to seek members As this is written there seem to be at least three in the field although their relations change rapidly from day to day Details of the battle appear elsewhere in this issue The aims and the motives of all of them are high and each has within its membership men whose sincerity is far beyond question At present their objectives are very close and well worth seeking But non-scheduled flying cannot speak through several months and the likelihood of useful accomplishments would be greatly enhanced if the field were narrowed down to a single powerful organization

Gas taxes are ugly things at best and ordinarily we are not in favor of them but there are a few cases where they are able to do a real service to aviation, In these we withdraw our objections An outstanding example is the State of Tennessee whose rate is among the highest yet nobody seems to mind The first reason is that one half of the seven cent tax goes to the development of the airport at which the gas is sold The second is that the other half is used effectively for promotion with a minimum of regulation Everyone knows that the State Aeronautics Commission bought five Cubs last year and gave free flight training to 75 citizens and ground school courses to hundreds This year the flight work will be farmed out to properly qualified schools and everyone will be even happier Let this be a lesson to states who squander large sums on activities whose benefits to aviation are vague if not downright negative.

This industry is shy on salesmen but there are a few that we could ill afford to be without The two we are thinking about most this month are Al Bennett and O J Whitney Both of these fellows have so many selling ideas that some of them are bound to be good. Al has just come through with a scheme to cash in on all this World's Fair publicity that has been floating around He offers a free trip to the Fair, a couple of weeks board and lodging and free flight instruction with the purchase of a used ship Details are given elsewhere in this section Another Bennett idea is a "Used Plane Lot" along some busy highway. We will tell you more about this later O J's contribution is an inviting four-page mailing piece which includes, among other things, a few true life stories of some of his charter trips that you just can't help reading These fellows are making a real contribution to this business which will someday be reflected in their own incomes It will pay us to watch them closely

"NO ONE BOUGHT ME A LUNCH when I started flying." With these words Casey Jones spun the Aeronca prop for the inaugural flight of the N.Y.U. group of the C.A.A. Training Program, following a luncheon given the students and others by Vincent Bendix at Bendix Airport.

199 C.A.A. Student Pilots Soloed

3386 Hours Logged and 4 Private Certificates Granted

WHILE House and Senate were debating on the amount of funds to be appropriated for the Civilian Training Program, the experimental phase of the work was progressing rapidly. As of April 12, 199 of the 325 students enrolled had been soloed and 4 received private certificates. A total of 3386 hours had been logged.

At Bendix Airport the New York University group got off to a slightly late start at a luncheon given by Vincent Bendix and attended by State and County officials and members of the aviation industry. Ground school work is under the direction of Prof. J. M. Coburn of N.Y.U. and flight work is under the direction of Ed Gorski of Standard Aviation, which has just placed an order for six Aeronca Scout Trainers for immediate delivery.

To determine the attitude of the student body toward the course, students of North Carolina State College have been asked to fill out a questionnaire covering proposed costs of training, time students are able to devote for flight work, academic credit expected, and possible methods of college and operator to promote private flying.

The Private Flying Division, C.A.A. is hard at work laying the groundwork for the continuing program so that it will be ready for operation as soon as the enabling legislation has been passed. Uppermost among the problems is that of providing for the non-college man. It is hoped that some arrangement can be made whereby the usual entrance requirements for extension courses can be waived as was done in some cases in the experimental program.

Flight Training Log As Of April 12

Name	Students Certified	Total Hours	Students Soloed	Private Certificates
University of Alabama	20	405	29	—
Georgia School of Technology	50	219	7	—
Kansas University	20	240	20	—
Massachusetts Institute of Technology	20	93	2	—
University of Michigan	20	285	19	—
University of Minnesota	20	62	2	—
New York University	20	75	2	—
North Carolina State College	20	128	9	—
Pomona Junior College	18	139	14	—
Purdue University	50	1005	50	4
San Jose State College	15	264	15	—
North Texas Agricultural College	50	365	20	—
University of Washington	20	94	None	—
Totals	325	3386	199	4

200 students are on the books of the Graham Aviation Company, successors to the Pyper Flying School at Pittsburgh Butler Airport. Three Franklin 50 Cubs, two Continental Aeronca Chiefs, and a Lambert Monocoupe are used. The school is under the direction of D. Norman Kite with Kenneth W. Scholter and W. C. Ludington also instructing in flight work. Ground school classes, in downtown Pittsburgh, are conducted by Everett E. Hert and Mr. Kite.

Complete instrument training in 100 and 250 hp. ships is offered under the personal supervision of Ken Unger a veteran of 26 years of flying experience. He was with the Royal Air Force. He later instructed flying for the United States Army and was one of the first Air Mail pilots who flew the mail in the early 1920's. Unger Aircraft, Inc. has been offering flight instructions since 1927 at Hadley Airport. Equipment for instrument training consists of a New Standard and a Stinson Reliant. These ships are completely equipped, including two way radio. Flying equipment available for student flight instructions and charter work ranges from Aeronca's to a new Lockheed '12' with Wasp 450 hp. engines.

You learn about giros at New York University. A new graduate curriculum on rotary wing aircraft will be offered during 1939-40 by the Guggenheim School according to a recent announcement by Dean Thorndike Saville of the College of Engineering. Courses are open to students qualified in aeronautics, mathematical physics or allied fields of engineering and include a fundamental course in aerodynamics and structural theory of rotary aircraft. Additional courses include advanced machine design, applied mathematics, theory of elasticity, and dynamics of aircraft.

A record increase in enrollment at California Flyers School in Los Angeles, has caused the largest expansion program in the history of the school. A large new hangar and additional shops and class rooms adjoining the main building have been recently acquired. The greatly enlarged motor maintenance and sheet metal and riveting divisions of the school are being moved to the new building. For cross country flying as a destination for student Breakfast Club hops the school has acquired an 80-acre Rancho with its own airport near Palm Springs.

Two new instructors have been added to the teaching staff of the Luscombe School of Aeronautics — James L. Hemsworth and Walter H. Hancock. Hemsworth's previous experience includes work with the U. S. Army Air Corps and maintenance work with T.W.A. and Kellett Autogiro Co. He is at present a member of the Air Corps Reserve. Hancock holds a Vocational Teaching Certificate as an approved instructor in aviation mechanics issued by the Massachusetts Department of Aviation. His experience also covers 2½ years at Worcester Airport. He was also associated with Clarence Chamberlain.

Boeing School has added John Felton Turner to the faculty as instructor in transportation and commercial air law. Mr. Turner is chairman of the Aviation Committee of the U. S. Junior Chamber of Commerce.

DART FLEET. Three of an order of five Dart Monoplanes are being used at Parks Air College in St. Louis. The fourth is at work for the Alabama Institute of Aeronautics at Tuscaloosa and the fifth is soon to be delivered.

The Test Pilot Looks at Aircraft Safety

(Continued from page 21)

The necessity to aid lateral control with violent skidding through the use of the rudder is to be lamented and is considered dangerous. The demands on the rudder caused by the conventional landing gear and the stalling and spinning possibilities, coupled with its partial blanketing by wings, fuselage, and flaps, produce a control which is excessive and dangerous in normal flight. Slipping and skidding can be the source of great trouble. Well-rounded fuselages with small vertical tail or fin effect have been found to make easily possible the complete stalling of the vertical tail and the reversal of rudder forces. The dangers of such a situation can be further appreciated when it is realized that changes in yaw are usually accompanied by large changes in pitch.

One must not lose sight of the fact that to be sold to the masses flying must be inherently safe. Detrimental control should not be placed at their disposal. Acrobatics can be eliminated as unnecessary. Slipping and skidding to any but a very slight degree are unnecessary for normal flying and maneuvering. The large normal lifting force acting on a wing, if inclined laterally, has a component well ample to produce the turning that is necessary for normal flying. The requirements for rudder control can and should be reduced to that of a trimming tab correcting for torque variations due to power and speed changes. Supply all the control necessary, but no more! For obvious reasons the use of the tricycle landing gear and elimination of the stall, and improved stability in flight, will do much to assist the accomplishment of such a simplification.

In the case of a multiengine airplane, the rudder takes on a somewhat different aspect because of the necessity to overcome unsymmetrically applied thrust. The magnitude of the control required to overcome aileron yaw is a minor factor. It is true that directional trimming for various conditions of power and forward speed is required, but the demands for this effect are small. In the case of the multiengine airplane, with regard to the possibility of engine failure, it is generally agreed that sufficient rudder must exist within the capacities of the pilot to apply it to compensate for the unsymmetrical thrust which remains. It is believed, however, that more consideration should be given to the design of the fin and directional stability independent of the rudder control so that the demands on the rudder are decreased when such a condition occurs. Thus can the possibilities of violent resulting motions be reduced.

Present designs seem to be based on the requirement that the pilot make a control deflection immediately an engine fails with little consideration as to what happens should he fail to do so. It can easily be seen that such human failing can occur under the strain of conditions such as a take-off at night in bad weather, with the added disadvantages of retracting landing gear, adjusting power, and interpreting other instruments. The design suggested would lead to a decrease in the rate and magnitude of the dynamic motions resulting from engine failure causing a violent change in heading and nosing downward due to the skid, which seems to be the cause of many accidents. It is expecting too much of the pilot and too little of the designer to expect continued alertness on the part of the pilot to avoid disaster in the case of engine failure in multiengine airplanes. There is no reason to believe that an airplane could not be designed in which, when an engine fails, the airplane would yaw slightly and slowly and continue generally on its way without further disturbance, even though slightly offset laterally and possessing a slight skid.

Under ideal flight conditions of smooth air and good visibility, the requirements for lateral control and stability are small. The same can be said for a bicycle. But did anyone ever try riding one on a rough surface and without space reference? Lack of attention allows the immediate build-up of a vicious cycle leading to disaster.

It does not seem unreasonable to expect that in the case of an airplane the design be so arranged that the wings would not only tend to, but to their own accord would, remain level. Of course, all designs incorporate some dihedral effect or correct roll due to yaw. And all have some degree of directional stability. But the proper combination of these qualities in such a way that, with absolutely no attention on the part of the operator, the airplane will always wander along on a nearly straight or series of straight flight paths and always *right-side up* is *rarely* encountered. Spiral stability does not exist, not that it couldn't—simply that it is not required. It seems necessary in the interests of safety. This does not mean that suppressed fin area with relatively excessive dihedral has not been observed to be unfavorable. It does mean that both extremes are undesirable and the happy mean should be sought. Whether the vertical tail area required to meet this condition would conflict with the thoughts heretofore given on the rudder is uncertain at present. However, it should be possible to so simplify the airplane that the attention of the pilot is merely required to supply geographic directive sense.

The presence of violent lateral instability at low speeds in most all types is associated with and discussed in connection with the stall.

Stability in the form of an automatic pilot is not cheap. It is in many cases desirable, but subjected to the same requirements as is the human pilot. Designers should not rely too heavily on its installation but should build a higher degree of inherent stability into their ships. Too much is at stake in the event of failure.

Longitudinal Control and Stability

Elevator controls occupy a position somewhat similar to that of the rudder in that they, too are usually more powerful than desired. Extreme changes in center of gravity, power, and flap-trim requirements cause large variations in the location of the elevator angle range needed for the specific conditions. Thus, an excess is available in each and the total range is large. Again, there is evidence of small trim changes leading in the direction of safety.

The elevators necessary for maneuvering are determined by their ability to produce the design normal load factors. In this respect, the inertia of the entire system plays an important part. Except under extreme conditions, no difficulty has been experienced in making pull-ups to prove the design load V-G diagram.

The use of the tricycle landing gear reduces to a minimum the landing requirements made of the elevator to get the tail down. Such a condition frequently is met. The minimum speed attainable in the air is not

(Turn to page 82)

Aircraft Safety

(Continued from page 80)

always possible near the ground.

From the standpoint of the pilot as well as the passenger, it is desirable that an airplane should fly and continue to fly, of its own accord, in the attitude and at the speed for which it was originally trimmed. Any deviations that cause a departure from the original condition of equilibrium should be caused only by conscious effort on the part of the pilot, and *greater* conscious effort should be required as the stall is approached

Longitudinal stability has been found to be suppressed to the limit Thus again is the elevator control accentuated The desirable qualities of stability, as examplified by good biplanes, are conspicuous by their absence in most modern low-wing monoplanes Static stability, as determined by measurement of control force and elevator position required for trim at speeds throughout the flight range, is small and marginal Approach to neutral, or actual instability frequently exists at law speeds in some power, loading, or flap condition Realizing that the requirements of control and stability generally conflict and that conditions which lead to greater stability also lead to greater control stiffness and less maneuverability, it is apparent that in present designs a great increase in longitudinal stability is desirable and necessary This is particularly true for each of the conditions of power-on and controls free at low speeds and high angles of attack. In the interests of safety, and with due regard to pilot's strength in the case of large airplanes, more demands must be made for improvement in stability Again the automatic pilot should not be considered as a cheap form of stability The compromises necessary in the case of the large transport airplane with its variable load are appreciated. Less excuse can be made for the smaller airplanes

It is well-known and required that some form of dynamic longitudinal stability is desirable This stability has to do with the nature of the oscillations resulting from a disturbance Other than that the oscillation be damped out, little is known concerning the desirable degree of subsidence. All degrees up to oscillations which do not increase in magnitude are daily met. Long-period oscillations, having a period of from 30 to 40 seconds seem to be of small consequence. As a matter of safety, it is desirable that they damp out eventually, but under human guidance they can, with little difficulty, not be permitted to exist sufficiently to disturb passengers.

Short-period oscillations or hunting having a period of 1 second or so, if not normally and rapidly damped, become very annoying It is considered unsafe at speeds near the stall because of the angle-of-attack variation with which it is associated. It is particularly disturbing to the pilot at cruising speeds if its frequency gets in phase with that of the horizontal tail control, as was experienced quite recently

Stall

All types of airplanes lose their rolling stability more or less sharply at some angle of attack The presence of this unstable condition near maximum lift with its resulting altitude loss and attitude change, in addition to effectively increasing landing speeds, constitutes one of the greatest dangers attached to stalling existing airplanes The basic solution of the stalling problem consists of the elimination of rolling instability Lacking this feature, warning of its loss is required, as was mentioned under discussion of longitudinal stability and control It is realized that the large center of gravity and power changes on the "must" list of the design for transport service place a long way into the future the possibilities of completely suppressing stalling in large airplanes These conditions do not appear as limitations on the smaller types where stalling could and should be prevented If it must be tolerated, however, it is not unreasonable to expect that the resulting roll not be violent and that the attitude, speed, or angle of attack at which it will occur be definitely defined and heralded well in advance. Much has been learned about the stall and its control, but the subject has by no means been exhausted. It is generally recognized and borne out by tests that small taper in the plan form of the wing and wing-tip slots have a marked effect on improving the stall. Performance compromises, however, have suppressed their general use. There can be no doubt that much more time and thought need be given to improving stalling characteristics. Control through the stall range, without stability, has appeared most unsatisfactory. Stability here requires but little accompanying control!

Every effort has been made to discover the useful value of stalling and spinning None has been found Why should the attainment of such a useless and dangerous condition be placed at the disposal of the operator?

Take-off and Landing

In take-off and landing, good control should, if ever, exist. As previously mentioned, improved stability in the design should be expected to bear a greater portion of the responsibility in this all-important and inevitable but uncertain condition of ground contact. The certainty is the essence of safety

Good landing characteristics demand that the airplane not be too clean or free of drag in the approach condition. Similarly, the application of flaps to a high degree can be unsafe because of the delicacy of the flare required for landing, and confusion resulting from the large trim changes generally associated with flap and power application The actual landing must not require too delicate nor too skillful an operation of controls In this respect, and particularly for the private operator, the freedom allowed the operator by the tricycle landing gear again makes it particularly attractive. The hazard which exists in the event that an immediate take-off after landing is necessary cannot be overemphasized The quick-operating flap incorporating both high and low drag possibilities with no variation in lift has been found to simplify judgment and improve glide-path control It is felt, however, that flaps should be incorporated in the safe airplane with great caution They are now generally used to allow an increase in wing loading, a most important factor in both take-off and landing safety, as well as ability to maneuver

Before closing there is one other point to which attention should be called All that has been said thus far pertains to airplanes But there are other types of aircraft available In seeking safety in flight for the private owner and relatively unskilled operator, the advantages of rotating-wing aircraft become increasingly apparent and should not be overlooked The possible attainment of parachute-like stability, good control at extremely low forward speeds, steep angles of climb and descent, and freedom from stalling with its present disadvantages certainly seems worthy of sacrifice in performance

It is not to be expected that any single invention will make all flying safe But, since the regulation and

(Turn to page 84)

(Continued from page 22)

education demanded of the operator or pilot vary inversely with the inherent safety in design, every effort must be put forth to improve basically the airplane itself by the incorporation of known and proved desirable characteristics Safety in flight can only be achieved through the patient and persistent application of the results of fundamental research.

Tests made to date on existing airplanes indicate that many reasonably desirable characteristics are not unattainable; their present absence is due for the most part to performance compromises *Safety* in flight can be greatly improved.

Machine Shop at Vultee

(Continued from page 25)

A much smaller part presented a somewhat bigger problem It was required to mill a radius of approximately 8 ft. on a small cast-aluminum bomb-rack fitting, making it necessary to rig up a rather bulky superstructure for attachment to a vertical mill. This supports a long arm, the head of which carries a fixture for supporting the work. The head of the arm is in turn retained in a slide fixture clamped to the mill table. Thus the table may be traversed backward and forward in the customary way in order to carry the work, on its swinging arm-sliding head support, past the vertical milling cutter in the required arc. This swinging-arc milling operation on the shoulder of the bomb-rack bracket is the third machine operation required. The first is a straddle milling operation on the center flange of the bracket Then it is necessary to drill a number of small bolt holes in each shoulder of the bracket, on each side of the center flange The third operation is the radius milling of the shoulder as described above. This bracket is also faced on a shaper and drilled for attachment to the structure of the plane.

Another example of the type of machining required for the Vultee attack-bomber is that done on the magnesium-alloy control-pedestal casting This complex casting is a hollow box of extremely irregular shape. Throughout the plane we have numerous other such boxes, as gear boxes, etc., but the control pedestal is the most complex It carries multiple control levers for actuating the carburetor, altitude adjustment, propeller setting, flap extension, landing gear retraction, etc Machine work is done mostly in a miller and includes boring, reaming, and facing

An excellent piece of precision milling and drilling is done on the alloy casting used at the attachment point of the center-section main wing beam to the major fuselage bulkhead ring This casting is step straddle milled, the ends being cut narrower than the center portion of the casting, which must fit between the gusset ears of the top and bottom cap strips The main body of the casting is then straddle milled to take the fuselage rings which are attached both to this casting and to the spar-cap gusset plates which also straddle the ends of the casting. It is obvious that the drilling operation calls for precision because, at the ends of the casting, long through bolts must pass through two fuselage rings, both gusset plates of the spar caps, and the cluster casting proper. This drilling is done in a symmetrical jig which is reversed to drill from both sides Holes are then reamed to close tolerance.

Another precision milling and drilling operation is that performed on the large aluminum-alloy castings used in attaching the landing gear to the stub wing. As the gear must retract and extend, in addition to bearing the heavy loads of landing in rough fields, this part must be processed to very close tolerances, particularly with respect to parallel milling between three separate pairs of ears and to the facing of bottom and top surfaces which control mounting of the fitting to the airplane structure Sequence of operations first calls for parallel milling between all three flanges or ears The bottom faces are then located and milled with reference to the finished surfaces of the ears Thereafter it is relatively simple to locate and drill a total of 34 holes, some of which are angle holes and seven of which are threaded for machine screws.

Another interesting item is the aluminum-alloy rudder-pedal arm. This part has a long bearing hole at the base, and a shorter bearing hole at right angles to the base in the upper end of the arm Temporary set-ups are used for this work, which is performed largely in a horizontal mill. The long hole is first bored and the ends of the long cross arm are then milled for center distance. The short hole is then located and bored and the ends milled. A vee block and bushing is used for drilling attachment-bolt holes in both cross arms, the tool used being a combined drill and facing cutter, which continues on down and mills off the shoulder after drilling the hole. This operation is performed from both sides of the casting to check alignment of the bolt hole and face both shoulders.

One of our important machining jobs is finishing the landing gear axle and oleo-cylinder assembly This is a single structural unit assembled from steel tubing and flat sheet-steel plates, welded together It is a costly part to manufacture, even before machining, and is extremely important in the operation of the airplane inasmuch as it carries the entire weight of the main wheels and provides for the shock-absorbing action which helps smooth operation on rough fields This part mounts vertically in the landing gear leg, which is in turn retractable into the wing of the airplane. In operation the oleo cylinder slides up and down in the main support strut, being guided on slides by two vee blocks. The wheel axle is cantilevered at right angles to the oleo cylinder from a heavy support at the bottom of the unit. Machine operations include boring of both holes and milling the vees. The oleo cylinder is first rough bored with a gun drill mounted in a lathe, after which the end of the cylinder is turned and threaded on the outside diameter to take the packing collar. The cylinder is then reamed with an adjustable reamer and honed to a tolerance of 0.0015 in The short axle-support hole is bored on a horizontal mill, the set-up providing for boring and reaming the hole and turning the outside diameter of the stub tube to take a felt grease retainer, all with the same boring bar Final operation is the milling of the two guide vees with special cutters; this is done to close tolerances since the vees serve as mountings for bronze vee blocks which act as sliding bearings for the landing gear vertical shock-absorber action These bronze vee bearings are premachined to a high degree of accuracy and assembled directly to the vees by means of long through bolts accommodated in holes drilled just inside the trough of the vee

Stacks and Rings

(Continued from page 27)

collectors in particular must be rugged and trouble free to avoid any possibility of fire starting due to a failure in service. Within limits the heavier the gage of the material used in construction the more resistant it will be to failure due to overheating, vibration, or corrosion. The problem involved is the design of a light collector ring rugged enough to stand up in service.

The three materials available and practical for the design of exhaust collectors together with their relative weigths, are as follows:

Material	Specific Gravity	Weight (lbs./cu. in.)
S.A.E. 1025 Carbon Steel	7.84	283
18-8 Corrosion and Heat Resisting Steel	7.86	284
Inconel (Nickel-Chromium—iron alloy)	8.55	309

The weight of standard size exhaust collector tubing in 100 inch lengths of each of these materials is given in Table 1 which was published in the first article of this series.

Experience has shown that these materials in 18, 19, and 20 gage are satisfactory in practically all installations. These gages correspond to .049 inch, .042 inch, and .035 inch respectively. .035 inch material is used for short exhaust stacks, or exhaust collectors for engines developing under 500 horsepower. In general the Army and Navy require exhaust collectors to be made of .042 inch material or heavier. In the large diameter tubing required for the latest high horsepower engines it is believed advisable to use .049 inch material.

The author has calculated the weight per horsepower of a large number of typical exhaust collectors. The average figures given below may be used for a preliminary estimate of the weight of an exhaust collector for a new design. For engines under 500 horsepower the average weight of exhaust collectors is .06 lb./hp., for engines over 500 horsepower the average weight is .042 lb./hp. Exhaust collectors for engines over 500 horsepower frequently incorporate intensifier tubes for preheating carburetor air. This intensifier type collector averages .07 lb./hp. Exhaust collectors for twin-row engines are slightly heavier than the foregoing averages due to the additional weight of the exhaust elbows leading from the larger number of cylinders. An average weight of .05 lb./hp. is reasonable for twin-row exhaust collectors.

As engines reach and exceed the 1000 horsepower stage the weight of the exhaust collector per horsepower decreases somewhat. This is due to the fact that the cross sectional area of any section of a ring varies as the square of the diameter while its weight increases only as the first power. In other words the greater the engine power, the larger the diameter of the tube, and the less the weight per horsepower of that tube. This reduction in weight per horsepower with increase in power is, of course, predicated on using the same thickness of material. The author believes that .049 inch material will be satisfactory for use on engines developing up to 1800 horsepower. In this case the average weight ratio will diminish from .04 lb./hp. for 1000 horsepower engines to about .03 lb./hp. for 1800 horsepower engines. Fig. 10 shows an exhaust manifold for the 1500 horsepower Wright R-2600 engine which is currently the highest powered engine in commercial use in this country.

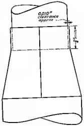


Fig. 5 Grumman type slip joint

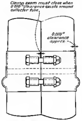


Fig. 6. Solar type slip joint

Material

The number of materials suitable for use in exhaust collectors is limited by the severe requirements. A suitable material must retain a large measure of its strength at temperatures from 1200° F. to 1400° F. which is the normal operating temperature range of exhaust collectors. The material selected must neither burn nor scale at these temperatures. Furthermore the material must be very corrosion resistant without protective plating or paint since these finishes will not stand up under the high temperatures encountered. To further aggravate this corrosion problem the ethyl lead in the high octane gasoline used with high power engines is very corrosive when deposited by the exhaust gases on the inside of exhaust collector rings. After a material has satisfied the technical requirements it must still be commercially available at a reasonable price, relatively light in weight, and easily fabricated. This latter point is very important since collectors are necessarily comprised of numerous parts which are curved in one or more planes.

The only materials currently available that satisfy the foregoing requirements to any extent are:

S.A.E. 1025 Mild Carbon Steel

18-8 Corrosion and Heat Resisting Steel

Inconel (Nickel-chromium—iron alloy)

S.A.E. 1025 Mild Carbon Steel

This material is commercially available in the form of sheet or seamless tubing. Its chemical composition is as follows:

Carbon	.20–.30	Phosphorus (Max.)	.045
Manganese	.50–.80	Sulfur (Max.)	.055

(Turn to page 88)

Stacks and Rings

(Continued from page 86)

The physical properties of S.A.E. 1025 steel are:

Ultimate Tensile Strength	55,000 lb./sq. in.
Yield Strength	36,000 lb./sq. in.
Elongation	22%

This material can be readily fabricated and welded to any desired form. In sheet form it can be bent through 180° without cracking over a diameter equal to its own thickness. It welds excellently with an oxy acetylene flame.

This material has the disadvantage of being easily corroded when not protected by plating or paint. A number of heat resistant paints are on the market to protect this type material when used for exhaust stacks or collectors. These paints protect the exterior surfaces for a time but the exhaust gases corrode the inside surfaces. Exhaust systems of this material are very unsatisfactory from a corrosion viewpoint when installed on engines using high octane gasoline containing ethyl lead.

S.A.E. 1025 mild carbon steel has been used for short exhaust stacks and collectors on low power engines. It has also been used for exhausts on engines undergoing test runs where a new design of stack is frequently needed. Its cheapness and ease of fabrication are important considerations in this type work.

18-8 Corrosion and Heat-Resisting Steel

This material is commercially available in the form of sheet, seamless tubing, and welded tubing. There are several variations of this material depending on whether columbium, titanium, or molybdenum is used as the stabilizing agent. The following chemical composition covers each of these variations:

Carbon	.07	Max
Manganese	.20–.70	
Phosphorus	.030	Max
Sulfur	.040	Max
Chromium	17.0–20.0	
Nickel	8.0–10.0	
Silicon	1.50	Max
Copper	.50	Max.
Columbium or	.50	
Titanium or	.20	Min.
Molybdenum	2.00	

The titanium content must be approximately 5 times the Carbon content.

The physical properties of this material are:

Ultimate Tensile Strength	80,000 lb./sq. in.
Yield Point	35,000 lb./sq. in.
Elongation	40%
Melting Point	2550° F.

This material can be readily fabricated but work hardens rapidly. If excessive forming is required it may be necessary to anneal the material before completion of the forming. The work hardened material can be softened by heating in a furnace at 1575° F.–1625° F. for from 2 to 5 minutes, and then allowing it to cool in still air.

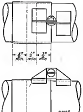


Fig. 7. Army type slip joint

This material welds beautifully with an oxy-acetylene torch. A slightly reducing flame should be used to avoid a porous weld. The material adjacent to the weld is subjected to temperatures within the 1000-1550° F. range and are open to intergranular corrosion unless given a corrective treatment. Within the temperature range from 1000-1550° F. carbides percipitate at the grain boundaries and subsequently cause cracks due to embrittlement. The use of material with a low carbon content and containing one of the stabilizing elements such as columbium, titanium, or molybdenum will avoid much of the intergranular corrosion and cracking. This type of stabilized material must be used for satisfactory service since exhaust collectors are repeatedly heated to the embrittlement range.

To relieve fabrication and welding strains and to stabilize the material adjacent to the welds it is essential that the finished collector be given a so-called stabilizing heat treatment. This stabilizing treatment consists in heating to 1940-1960° F. for ½ hour followed by cooling in air. When the exhaust collector is heated to this temperature it becomes very plastic and each section must be independently supported to prevent distortion. If the furnace available is not capable of reaching 1900° F. an alternative stabilizing treatment consists in heating to 1575-1625° F. for 2 hours followed by cooling in air. The author has had considerable experience with exhaust collectors stabilized at these lower temperatures. They have had a uniformly successful service record free from cracks.

In order to clean up the collectors after welding and heat treatment they should be given a light sand blast followed by pickling for one hour. The pickling solution should be a 50% solution by weight of hydrochloric acid maintained at 130-140° F. After pickling the work must thoroughly rinsed in hot water to insure removal of the acid.

The final finish operation on a collector of corrosion resisting steel is passivating. Passivating consists of immersing the work for 20 minutes in a solution containing 20% nitric acid at a temperature between 120-150°. The material must then be washed thoroughly in warm water. Passivating accelerates the formation of a tough, passive oxide film on the surface of the material. It is this film that makes the material corrosion resistant.

The vast majority of present day exhaust collectors are manufactured of 18-8 corrosion and heat resisting steel. This material has an excellent service record and is only challenged in this field by Inconel.

Inconel (nickel-chromium—iron alloy)

This material is commercially available in the form of sheet, seamless tubing, and welded tubing. The seamless tubing is used for carrying hot air from the exhaust to the cabin heating system because of its strength and reliability at high temperatures.

The average chemical composition of Inconel is:

Nickel	78.0	Carbon	.08
Chromium	13.5	Copper	.48
Iron	6.5	Silicon	.35
Manganese	.35		

The physical properties of Inconel are:

Ultimate Tensile Strength	80,000 lb./sq. in.
Yield Point	35,000 lb./sq. in.
Elongation	45%
Melting Point	2540° F.

Inconel has the property of retaining high strength at elevated temperatures. It has an ultimate tensile strength of about 40,000 lb./sq.in.

(Turn to page 94)

The Unitwin Vega

(*Continued from page 31*)

Single engine performance.

The drag of a twin-engined airplane operating on one engine is greater than in normal flight due to the drag of the dead engine propeller and the drag caused by attitude of the airplane and control displacement necessary to offset eccentric thrust and lift. These effects will require approximately 30 hp for a plane of Type B. This is small compared with total power available but is important in its affect on climb and ceiling. For example, the rate of climb of a 6000 lb. airplane operating on 300 hp will be reduced by 165 ft. per minute or approximately 30 per cent. The single-engine ceiling will be reduced in the order of 20 per cent. This difficulty is entirely eliminated with Type A, since, with Unitwin power there are no eccentric thrust or drag forces in event of failure of a single engine, but merely a reduction in total power available, and a slight reduction in efficiency of the single propeller of constant speed type due to the new operating condition.

Noise level in cabin

The sound intensity of a propeller is greatest in the plane thereof, decreasing to a minimum at points along the thrust line. Therefore, the noise from the propeller mounted on the nose will seem less intense to occupants of the cabin than will the noise from propellers operating alongside the cabin.

Weight comparison:

The weights of powerplant installations for airplanes of Types A and B are approximately as follows, assuming that both types use geared engines and are equipped with constant speed propellers.

Type A (Unitwin) .... 1425 lb.
Type B (2 nacelles) .... 1460 lbs.

With the Unitwin Vega, if an engine fails *at any time in flight* the airplane continues to fly in normal fashion but at reduced power. The constant speed propeller automatically seeks the pitch most efficient for the new condition and the pilot is able to proceed to his destination, or to a precautionary landing, without exercise of unusual skill. Since the Unitwin relieves the pilot of many problems of airplane and powerplant control under single engine conditions, he is more free to devote himself to judgment of procedure under such circumstances.

It may be noted that failure of the single propeller will subject the Unitwin powered airplane to complete loss of power. However, a study of airline experience shows that there has never been a hub failure on a constant speed propeller. And propeller blades and operating mechanisms normally function without difficulty for a period many times greater than the normal operating life of an airplane, assumed to be 5000 hours.

J. CADEN JENKINS
Sales Department, Vega Airplane Co.

Designed to carry five or six persons, the Vega will have a maximum speed of approximately 210 m.p.h. and will cruise at 166-184 m.p.h. for a distance of 570 miles. A trailing edge type flap is incorporated in the wing.

The fuselage is a welded steel tube frame from the engine to the rear of the cabin, with the enclosure an unstressed metal sheel bolted to the frame. The two wing panels also bolt directly to the frame, eliminating a wing center section. The monocoque tail portion of the fuselage bolts to the frame at the rear of the main cabin. Although the landing gear retracts, the wheels extend sufficiently even in the retracted position, to protect the structure of the airplane in event of a belly landing. The cabin interior duplicates the finish of a large modern automobile. Five persons are accommodated in the private-owner version, and six for feeder airline use, in addition to mail, express, and baggage.

Specifications and estimated performance figures:

Length	30 ft. 3¼ in.	(9.89 m.)
Span	41 ft.	(12.51 m.)
Height	8 ft. 5 in.	(2.59 m.)
Wing Area	295 sq. ft.	(27.35 sq. m.)
Weight Empty	3 990 lb.	(1 810 kg.)
Useful Load	1,755 lb.	(796 kg.)
Gross Weight	5 745 lb.	(2 610 kg.)
Powerplant Rating	580 h.p.	(take off)
Fuel Octane Required	87	
Take off Run at Sea Level	577 ft.	(176 m.) still air, using flaps
Landing Speed at Sea Level	60.9 m.p.h.	(98 km/hr.) still air, using flaps
Maximum Climb at Sea Level	1 350 ft./min.	(412 m./min.) both engines
	350 ft./min.	(107 m./min.) single engine
Absolute Ceiling	23 500 ft.	(7 170 m) both engines
	11 500 ft.	(3 500 m) single engine
Service Ceiling	21 500 ft.	(6,550 m) both engines
	10 500 ft.	(3 200 m) single engine
Range	640 mi.	(1 030 km) at 5 per cent power (4 hr.)
	570 mi.	(917 km) at 67 per cent power (3.1 hr.)
Maximum Speed at Sea Level	195 m.p.h.	(314 km/hr.)
at 7 500 ft. (2 288 m)	210 m.p.h.	(338 km/hr.)
Cruising Speed at Sea Level	165 m.p.h.	(267 km/hr.) using 175 BHP/eng
at 7 500 ft. (2 288 m)	178 m.p.h.	(287 km/hr.) using 175 BHP/eng
at 12,000 ft. (3 660 m)	184 m.p.h.	(296 km/hr.) using 175 BHP/eng

Standard instrument equipment includes: Kollsman Compass, sensitive altimeter, airspeed indicator, vertical speed indicator, bank and turn indicator, clock, manifold pressure gauges (2), engine gauge units (2), techometers (2), carburetor air temperature indicators (2), Weston ammeter, an electrically heated pitot tube, head temperature gauge and selector switch, hydraulic pressure gauge, landing gear and flap gear position indicators.

Electrical equipment includes: Exide battery, Eclipse generator, Eclipse generator filter, instrument panel lights, 2 Grimes retractable landing

(*Turn to page 92*)

The Unitwin Vega

(Continued from page 90)

lights, dome and baggage compartment lights, fuel pressure warning lights (2), set of Grimes position lights, Western Electric master switch, Scintilla dual ignition switch, 2 3-minute flares.

Power plant and accessories include Unitwin Menasco powerplant, one Hamilton-Standard two-blade constant speed propeller, Hamilton-Standard control unit, 2 Stromberg carburetors, 2 Eclipse electric starters, 2 Young oil temperature regulators, 2 Pesco engine driven fuel pumps, Aircraft Accessories fuel unit, complete Lord vibration absorbing engine mountings, complete radio shielding, Eclipse landing gear oil pump, fuel system selector valve and control, fuel system cross feed selector valve and control, fuel system tank selector valve and control.

Stacks and Rings

(Continued from page 88)

at 1400° F. which is near the upper temperature limit of exhaust gases.

Inconel fabricates and welds even more easily than 18-8 corrosion resisting steel. It does not harden from cold working as rapidly as corrosion resisting steel. If necessary it can be softened by heating to 1800° F. for 15 minutes and quenching in air, water, or a dilute alcohol-water solution.

Inconel is not subject to embrittlement or intergranular corrosion as experienced with 18-8 corrosion resisting steel. In fact no heat treatment or finish of any kind is necessary after fabrication and welding. The weld is slightly more corrosion resistant than the parent metal. When inconel is heated above 700° F. chromium oxide forms on the surface. The oxide can only be removed by grinding or pickling but will immediately reform on exhaust collectors when heated. This coating does no harm and no effort is made to remove it.

Inconel is an excellent material for exhaust collectors but weighs and costs more than 18-8 steel. It is probable that it will excel 18-8 steel for use on engines developing 1500 or more horsepower due to its greater strength at elevated temperatures and its superior corrosion resistance.

Research Wins Wars!

(Continued from page 23)

under way. It is reported that the Russian Aero-Hydrodynamical Institute at Moscow has more than 3,500-5,000 employees engaged on research, development and experimental construction of aircraft.

At the moment we are in a peculiar position as far as our own research facilities are concerned. We possess some of the finest aeronautical research equipment in the world at the Langley Field laboratory, but the great demands of our present commercial aircraft development and our new re-armament program have already taxed the facilities of Langley far beyond their capacity. A committee whose membership included the Chief of the Bureau of Aeronautics, the Chief of the Air Corps, and the Chairman of the Civil Aeronautics Authority was set up last October to study the problem and report on a remedy. Their recommendations, after complete investigation of the situation at Langley Field and of the country in general, called for the expansion of the laboratory equipment at Langley up to the limiting capacity of the present site, and the establishment of a new research station on some established Army or Navy flying field located within a convenient distance of the aircraft manufacturing industry on the West Coast. Adding everything together, it seemed to the Committee that the Army field at Sunnyvale, Calif. was ideally suited for the second station.

Both General Arnold and Admiral Cook characterized it as a project "emergency in character and a vital importance to the success of our whole program for strengthening the air defense of the United States."

Stacking up our own research facilities against those of the totalitarian powers, two things become evident, (a) In quality, our work ranks with the best work abroad, on any count, but (b) quantitatively we are definitely trailing the field, coming off at a very poor second at best with Germany alone and lagging far behind the pace set by the combined Teuto-Italio-Jap group. One has only to compare the physical bulk of the DVL and the N.A.C.A. reports for 1938 to see what is going on. At a guess, Germany reported on at least twice as many research projects as did our own Advisory Committee, in the same period of time.

And so what? Does mere volume of research work count? It certainly does, in these critical times. Maximum performance is the essence of success in military aircraft, and new ideas to improve performance must be constantly developed and constantly checked by our laboratories in minimum time. Dr. Seewald touched on the answer in the opening remarks to his paper on the DVL when in discussing high speed and high altitude performance questions he said: "I believe that a research institute which answers these questions correctly and *as soon as possible* will have made an important step towards the successful solution of the problem."

Those words "as soon as possible" hold the key to the situation. Obviously, in war-time new ideas for performance improvement cannot be put on waiting lists for laboratory test. Large capacity is as important in research work as it is in actual production. At a time when we are preparing to spend hundreds of millions of dollars to build up our aircraft and engine production facilities, it is certainly short-sighted to curtail research expansion. There is a definite relationship between the two. Our military and naval aviation heads have pointed out that we need the Sunnyvale station now, and it is very likely that we may need two or three more like it before we are through. If we don't keep up in our research capacity we may never be in a position to regain that lead in technical advance which we have held so long, but which is now in serious danger of passing to more research conscious abroad.

Stinson 105

(Continued from page 29)

mum. Side walls and head-linings are trimmed in beige broadcloth. A two-tone effect is imparted to the beige broadcloth sidewalls by a horizontal stripe of tobacco brown Boucle fabric bordered by two stainless steel mouldings which encircle the cabin and join to form a decorative border at the top and bottom of the instrument panel. The central portion of the panel is finished in blonde Harewood and all instruments are indirectly lighted. The remainder of the panel is in beige. Control knobs are in Fawn plastics and panels of grooved stainless steel with vermilion insets decorate compass housing and throttle supports. Modernistic lettering is used on the special instrument faces.

Compass, air speed indicator, tachometer, altimeter, oil pressure and temperature gages, electric gasoline gage, carburetor heat and altitude controls and dual wheel controls are standard. Copilot's wheel and rudder pedals are quickly removable. Toe brakes of the Goodrich-Hayes Hydraulic Expander Tube type are operated from the left seat. Plexiglas is used in all windows and those next to the pilots' seats are of the sliding type. An intake tube in the wing feeds the ventilation system.

Outwardly the liberal use of stainless steel enhances the appearance by application to the grilles covering cooling air and carburetor air inlets and coverings for the exhaust pipes and forward step. Mouldings of stainless steel are used for windshield and window frames.

Landing gear is the full cantilever swinging beam type with Stinson oil and spring shock absorbers inside the fuselage. The gear structure is heat treated and fitted with replaceable bronze bushings. The 6.00x6 wheels use tapered bearings. Four ply tires are used. A full swiveling tail wheel mounted on a spring leaf shock absorber, is fitted with a self-centering anti-shimmy damper. Tire size is 6.00 x2. Provision is made for installation of skis or Edo floats.

Power plant equipment includes dual Scintilla ignition and controllable air heater for the carburetor. Oil is carried in a crankcase sump and cooled by a blast of air around the case. Standard equipment includes a storage battery. An electric starter is extra. A fixed pitch wooden propeller with metal tips is used. Eighteen gallons of fuel are carried in a tank in the right wing panel and gasoline feeds by gravity to the engine, via the usual shut-off valves.

NORTHWEST AIRLINES *Chooses Douglas*

Perfecting
A SERVICE ALREADY FAMOUS

True to the transportation tradition of the empire it serves, Northwest Airlines perfects its Seattle-Chicago service with luxurious Douglas DC-3 21-passenger airplanes. The Northwest has always enjoyed the best in transportation. In recognition of this, Northwest Airlines is adding these modern, most proven air transports in the world to an already famous service. Douglas Aircraft Co., Inc., Santa Monica, Calif.

GO "DOUGLAS" ON THESE WORLDWIDE AIRLINES

NORTH AMERICA: American Airlines Inc. Braniff Airways. Canadian Colonial Airways Inc. Eastern Air Lines. Northwest Airlines. Pan American Airways. T.W.A. United Air Lines. Western Air Express. Wilmington Catalina Airline. **SOUTH AMERICA:** Pan American Airways. Pan American Grace Airways. **AUSTRALIA:** Airlines of Australia. Australian National Airways. **EUROPE:** A. B. Aerotransport, Sweden. Air France, France. Avio Linee Italiane, Italy. C.L.S. Czechoslovakia. K.L.M. Netherlands. L.A.P.E. Spain. L.A.R.E.S. Roumania. LOT Poland. S.A.B.E.N.A. Belgium. Swissair, Switzerland. **ORIENT:** China National Aviation Corporation. K.N.I.L.M. in Netherlands Indies. Japan Air Transport

Congratulations To
DOUGLAS *on the* DC-5

We congratulate the executives, designers, project men and shop personnel of the Douglas El Segundo Division on their newest achievement, the Douglas DC-5. We are very proud that Kollsman Precision Instruments have again been chosen as standard equipment for a Douglas Transport.

Kollsman For Precision

KOLLSMAN INSTRUMENT CO., INC.

8008 FORTY-FIFTH AVENUE ELMHURST, NEW YORK

WESTERN BRANCH: GRAND CENTRAL AIR TERMINAL, GLENDALE, CALIFORNIA

AIRCRAFT EXPORT TRANSPORTATION SPECIALISTS

DISMANTLING: Cleaning—Spraying, etc.

PROTECTIVE WRAPPING: Motor and fuselage.

BOXING: Complete, wings and motors separate when required.

TRANSFERRING: By Lighter or Trucks.

INSURANCE: Arranged from packing point to foreign destination against all marine risks and war risks.

OCEAN TRANSPORTATION, arranged at lowest cost.

SHIPPING DOCUMENTS prepared, including export clearances and consular invoices.

Consult us for estimates—Mail specifications
All communications confidential

Cable Address "JENARDO"

J. E. BERNARD & CO., INC.

27 Pearl Street
NEW YORK CITY

Telephone BO 9-2330

CHICAGO	LONDON	PARIS	ANTWERP
11 So LaSalle	49 Leadenhall	5 Rue des Messageries	7 Place de Meir

Agents at all principal ports in the U. S. and overseas

Sealed and GUARANTEED!

SINCE pioneering the first aircraft radio equipment, the Radio Frequency Laboratories have maintained a policy which has been far reaching in its effect. The confidence which the manufacturer expresses in unconditionally guaranteeing these units for ONE YEAR—with never a service charge—is truly representative of the quality of RFL units. Today RFL aeronautical receivers and transmitters represent the finest that money can buy and are made available to you on a policy which deserves careful consideration before purchasing. New Bulletins which completely describe RFL equipment for your plane may be had for the asking.

RADIO FREQUENCY LABORATORIES, INC.
BOONTON, NEW JERSEY, U. S. A.

When Safety hangs by a thread

you can depend upon SWITLIK Safety Chutes

Every thread that goes into Switlik Safety Chutes is pretested for strength far in excess of the severest possible demands. Other exclusive safety and comfort features, absolute infallibility, compactness and lightness are additional reasons why, since 1930, we have furnished 69% of all the parachutes purchased by the U. S. AIR FORCES. Every type available for all commercial and military purposes. Switlik Chair Chutes now installed by the plane builder before delivery to you. Send today for your copy of free bulletins and catalogs.

Manufactured under Approved Type Certificates awarded by Civil Aeronautics Authority.

West Coast Dealer: Finney's Parachute Service, Glendale, Calif.

SWITLIK PARACHUTE & EQUIPMENT CO.
S. BROAD & DYE STS. TRENTON, N. J.

B·I·W
High Tension Aircraft Ignition Cable

Type P-I-7 IGNITION CABLE is specially designed to withstand heat and moisture.

After subjected to severe conditions of boiling water, steam, and high temperature, this construction surpasses all others in life under high voltage stress.

The outside covering is a special ozone resisting compound and the usual cotton fabric instead of placed on the outside where it will absorb moisture is vulcanized under high pressure between the walls of insulation. This provides the necessary reinforcing to withstand the electrical and physical stresses.

Send for our folder and test report on P-I-7 INTER-LAYER BRAID IGNITION CABLE.

LIGHTING AND POWER CABLES
SHIELDING — IGNITION CABLES
BONDING WIRE — ANTENNA WIRE
INSTRUMENT WIRES and
MULTI-CONDUCTOR CABLES

Manufactured for the Aircraft Industry by

Boston Insulated Wire and Cable Company
BOSTON, 25, MASSACHUSETTS — *Established 1905*

DEGREASER

A unique and valuable solvent. . . . The last word in quick removal of heavy mineral oil and grease accretions from fuselage, landing gear.

Gunk
CLEANS CLEAN

SAFETY

(a) Without fire hazard . . .

(b) Without harm to nitrocellulose lacquer, dope or aluminum skin . . .

(c) At lower cost—due to efficient water rinsing. Official approval as safe cleaner for use on aluminum and alloys.

THE CURRAN CORPORATION
6 Pleasant Street — Malden, Mass.

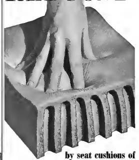
May be obtained from
Air Associates, Inc.

or Gunk is carried in stock at leading wholesale automotive stores in all principal cities.

Send post card for free booklet and name of nearest jobber.

LEAVES NO FILM! — SPRAY IT ON — SLUICE IT OFF

FATIGUE REDUCED



by seat cushions of U. S. ROYAL FOAM SPONGE

● Softer than flesh, Foam Sponge shapes itself to every contour of the body like a buoyant, yielding matrix. Weight is evenly distributed. Support is complete, utterly relaxing.

Millions of connecting air cells provide comfortable ventilation. Each is a tiny shock-absorber. Vibration is neutralized and sound deadened to a gratifying new degree.

Fatigue is noticeably lessened. Pilots remain fully efficient for longer periods. Passengers are gratefully refreshed. But comfort is only one of many advantages to designers, builders and operators of planes. Others are:

SIMPLIFIED CONSTRUCTION
WEIGHT AND SPACE SAVED
LOWER MAINTENANCE COST

May our engineers send you detailed information? Write

United States Rubber Company
MISHAWAKA INDIANA

What is FOAM SPONGE?

Pure milk of rubber trees is whipped into foam with air, then moulded to permanent shape. One light thin unit replaces springs and padding in seats and mattresses.

RUBBER WILL SERVE YOU BETTER

AVIATION'S MARKET PLACE

CLASSIFIED ADVERTISING

Aeronca

AERONCA K. 650 hours 150 hours since factory major. Perfect shape. Brakes. Lights. Tail Wheel. $700. Arthur Dibs, Floyd Harnett N Y C.

One AERONCA Airplane manufactured June 1938. Fifty horsepower Continental motor. Completely equipped for instrument rating training. Has radio, sensitive altimeter, rate of climb indicator, bank and turn indicator, speed control, clock, cabin heater, propeller spinner, wheel pants, extra gas tank with wobble pump, air speed indicator and other extras licensed with forty pound baggage and two parachutes. ... time 100 hours since new. Never scratched. Bargain for $1,895 with or terms or will take older ship in trade. Call or wire W. J. Evins, Smithville, Tennessee. (P)

Americas Eagle

OX AMERICAN EAGLE, excellent shape, good fabric, new air wheels, $300. JS 6 engine, good condition, $350. Jesse Jones, Lancaster, Pa.

Beechcraft

BEECHCRAFT, B 17 L. Jacobs 225, 5 place, 70 gallon. Radio. Engine driven generator. New Ray. Stravallia, finish. Licensed to April 1940. $2975.00. FS 501, Aviation, 520 North Michigan Avenue, Chicago, Ill.

Cardinal

CARDINAL, 2PCLM 100 hp Kinner Ex cellent condition $700. Write for details and for listing of aeronautical supplies. Sky Chief Supply Co., Ontarioville, Ill.

Eastman

EASTMAN AMPHIBION, motor majored, $1850.00. E4 Motors $225.00 each. A Cembee, 1132 Lessops St, New Orleans, La.

Fleet

FLEET MODEL 2 rebuilt all yellow, blue trim, has dual fish, ... wheels, steel propeller ... exhaust Kirner 100 h.p. ... Fleetrasing ... Chromium wires $1,350. E. W. Wiggins Airways, Inc., Box 121, Norwood, Mass.

Fairchild

1938 RANGER FAIRCHILD, Straemar finish, Black, Fabric, ... , Bank and turn, rate of climb generator. Time 1083 hours, 240 hours since major. Price $2500. Leech Aircraft Inc., Roosevelt Field, Mineola, N Y.

Reorwin

REARWIN, Late 1936 LeBlond Seven Thousand, Low Time. Beautiful condition, Standard equipment plus Kollsman Compass, Generator. Heater. Brakes. Speed Ring. Dual Controls, a fine 2 p. Airplane for only $1450.00. E. C. Rodding Company, Cleveland Airport, Cleveland, Ohio.

Sikorsky

TWO SIKORSKY S 38 Ten place Amphibians. Eaqaippea Wasp C Engines. Hamilton Standard controllable propellers. Two way Radio complete. Over-Water Equipment. Planes, Engines, A & Shape. Just relicensed. Palm Beach Aero Corp., Morrison Field, W. Palm Beach, Florida.

SIKORSKY—S-38B Twin Wasps SC-1 with 10 to 1 blower. Ship has total of approximately 500 hours, engines about 150 hours since completely overhauled and maintained by Pratt & Whitney. Ship is painted, re-conditioned throughout, in excellent condition. Propellers re-conditioned and etched by Ford Motor Company. Ship just relicensed. Address Matilda R. Wilson, Executrix Estate of Daniel G. Dodge, 1710 Fisher Building, Detroit, Mich.

Stinson

1936 Stinson Gullwing, total ship and engine time 730 hours. 35 hours since engine major overhaul. License until April 1, 1940. Full set of instruments and Radio Receiver, with Smith's controllable propeller. Price $3500. Snyder Aircraft Corporation, Municipal Airport, Chicago, Ill.

INDEX

AVIATION "Classified"—May, 1939

Undisplayed ads offering only ONE make of plane are grouped under that make. Others appear under "USED PLANES—General" and are numbered and indexed to enable readers to conveniently locate the makes of planes offered, or other items of interest. All other undisplayed and displayed advertising, except those relating to employment and business opportunities—are numbered, or referred to by number, and indexed for the reader's convenience in quickly finding ads.

Stinson, (cont'd)

STINSON SR-10C Demonstrator. Mono.... Salo Reliant. Red. Contrast. Gold Pin Stripe. ... ... Bank and turn, rate of climb, sensitive altimeter, manifold pressure, carburetor air temperature, generator, radio receiver, landing lights, flares, blind flight hood. Total time 250 hours. Price $8,700. Leech Aircraft, Inc., Roosevelt Field, Mineola, N Y.

STINSON SR-9CD Everscen, Dress Cream Contrast, Gold Pin Stripe. Broadcloth interior. Bank and turn, rate of climb, thermocouple, manifold pressure, carburetor air temperature, generator, landing lights, flares, radio receiver. Total engine time 603 hours, 283 hours since major. Airplane new September 30, 1938. Total time 55 hours. This ship has unusual flight characteristics including better than 1000 foot-a-minute climb. Price $6,700. Leech Aircraft, Inc., Roosevelt Field, Mineola, N Y.

Stinson, (cont'd)

STINSON 1937 SR9BD 245 H.P. Lycoming, Hamilton Standard Controllable pitch propeller. Excellent condition. 350 hours since new. Licensed to February 1940. Leering yellow with black trim. RCA receiver, Western Electric transmitter. Grimes landing lights. Navigation lights. Flares. 80 gallon tanks. Compass. Directional gyro. Turn and Bank. Sensitive Altimeter. Airspeed, rate of climb, thermocouple, Carburetor temperature gauge. Outside air temperature gauge, manifold pressure gauge and regular engine instruments. Night day clock. Pyrene extinguisher. Engine equipped with pressure extinguisher system. Price $5900 cash. Apply John Pillips Sefeir, Inc., Hangar 8, Roosevelt Field, Mineola, N. Y. Telephone Garden City 910.

STINSON SR-8B, absolutely perfect condition, low total time, blue and yellow, 245 H.P. Lycoming, 2 way RCA radio, bank and turn indicator. Many instruments. Intrim manifold pressure, carburetor temperature gauge and flight generator. Privately owned. Make offer. Buying new ship. L. G. Bruntter, Nassau, N. Y.

STINSON GULLWING 1936, Lycoming 245 h.p. grey and white Smith controllable propeller, blind and night flying equipment. Always in hangar, in continuity of owner. $4,500. Write Norwood Aero Club, Inc., Norwood, Mass.

Swallow

SWALLOW OXX6, Licensed, three place, split landing gear, DH wheels, Airspeed compass, Dark Y Doud. Cyl. price $325.00. Kohler Airport. A. Frank. 1119 N. 11 St., Sheboygan, Wisconsin.

Taylor (Cub)

1937 CUB DE LUXE Seaplane, Landplane. Cut condition. Frosted. ... Dual ignition, air speed, dual wheel lights. Edo floats. ... Licensed. $1095.00. Also have Sherre. Trade. "AF" Leeward, New Kensington, Pennsylvania. (T)

1937 Cub Silver and Red, Excellent condition. Endurance Dual ignition. Just overhauled. Relicensed and repainted. $850.00. William Peddle, Perry, N. Y.

Travelair

TRAVELAIR J-5 modernized. D... eight hours since major overhaul. Plane recovered a year ago. Completely equipped for aerial mapping and blind flying. Has two way radio, Directional Gyro, Sensitive Altimeter, etc. Price, with instruments, $2,500.00. Price with conventional instruments only, $2,000.00. Standard Aerial Surveys, Inc., 64 Park Place, Newark, New Jersey.

Waco

WACO A 1730 Jacobs. Vermilion and Silver. Major ... Just majored ... speed ring, turn and bank, air speed, many extras. Priced to sell. $1495.00. Frank P. Rizzo, 320 Grammont, Monroe, La.

Used Planes—General

(See Index on page opposite)

(See also Group Classifications)

Hannah Air Service offers Cubs, all models. $595 to $1445. Latest Coupe Challenger Robin, refinanced $675. Monocoupe $450. Aeronca C-3 $365. Waco OX Challenger $395. Moth, Avian. Taylorcraft, others. Financeable "Cubtown" Hightstown, New Jersey.

Waco Ten Duster 225 H.P. Lycoming, Good shape. Licensable. Also J5 Pitcairn. L. D. Jordan, 402 Washington, Houston, Texas. (No. 1)

Identified ARROW SPORT excellent, prefabricated. $250. Also practically new cracked Rearwin. John Warnock, 3244 Holdrege St, Lincoln, Nebraska. (No. 2)

AVIATION'S MARKET PLACE

Used Planes—General—(cont'd)

1939 Aeronca Chiefs, 1934 Aeronca $550.00. Dipsy Moth excellent $695.00. Lambert Franklin Sport $695.00. E 2 Cub $550.00. Fokker Universal 7 place. Kirner Eagle $495.00. SR8 Stinson Parts. Finance—Trade. "AF" Leeward, New Kensington, Pennsylvania. (T) (4)

Savoia Marchetti Amphibian $1100. Lycoming Stinson $1150. Waco "F" $1400. Kinner Bird $775. Fairchild cabin $775. J-5 Travelair Speedwing 1000. Late Moth $850. Aeronca C 3 $455. Warner Stinson $775. J6 7 Stearman $1250. Ox Travelair $400. "145" Monocoupe $2100. Porterfield $950. Irwin Exhibition Parachute (chest and back) $100. Used parts Engine and Wings. If you want buy, sell, trade or refinance, call, write, wire Pioneer Aviation, Airport, Syracuse, N Y. (P) (T) No. 5

USED 40 & 50 CUBS: We have a large inventory of fine '37 and '38 ships, many have low time and extra equipment. Prices from $700 up. Others include two 1939 Coupes, two 1937 Taylorcraft, 1939 Porterfield 70, two place Warner Fairchild 24 cabin, 1939 Aeronca seaplane on 1140 floats, damaged set Edo 1070 floats $200. E. W. Wiggins Airways, Inc., Box 121, Norwood, Mass. No. 5a

Engines & Parts

See also ads marked (P) in group Classifications

FREE AEROPLANE with motor purchase. Easy terms. $12.50 down. 200 pounds useful load. Welded steel construction. Propeller—all types—98c up. Sensational value. Illustrated information and flying manual. 25c. Universal Aircraft, Fort Worth, Texas. No. 6

Continental A 40 2 motor. 35 hours since complete overhaul at Continental Factory. Also Cub E 2 parts. Clarence A. Petty, Brushton, N. Y. No. 7

SPECIAL: Aircraft engines up to 300 H.P. Major overhauled for $50.00, engines to 250 H.P. $100.00 work supervised by licensed experts in Government approved shop. New York district. For particulars address FS 504, Aviation, 330 West 42nd St., New York City. No. 7a

Wright J6 5, 165 H.P., 150 H.P. Ranger. Wright J6 9 330 H.P. Lambert 90, late type, complete with ignition harness and shielded spark plugs. All motors have less than 330 hours total time with no time since major overhaul. Write for full details and prices. Snyder Aircraft Corporation, Municipal Airport, Chicago, Ill. No. 8

98 HP DH GIPSY ENGINE. Excellent condition, total time 88 hours, with prop and special Pioneer Tachometer. $125. N. Peterson, 324 Dreendale Avenue, Needham, Massachusetts. No. 9

Travel Air, Crock, Up's and Travel Air Parts, OX 5 Eagle Rock Fuselage complete. Three OX 5 Motors just overhauled. Scintilla Magnetos for OX 5 Motors. Lot's OX 5 Parts. Best Challenger Commander in Texas. $650 cash. Write for Prices on Crock Ups and Motors. Darrett Flying Service, P.O. Box 788, Graham, Texas. (P) No. 10

Equipment & Products

Fire Extinguishers

PRIVATE OWNERS: Protect your life and investment with a new Phylax Automatic fire extinguisher, only $15.00, including all fittings. FS 505, Aviation, 330 West 42nd St., New York City. No. 10a

Office Equipment

Typewriter 49.00. Duplicator $14.95. Adder $37.00. Addresser $15.00. Pruitt, 31 Pruitt Bldg., Chicago, Ill. No. 11

Parachutes

Parachutes bought, sold, serviced and rented. New York Distributor for Irvin Air Chute. Joe Crane, Roosevelt Field, Mineola, L. I., N. Y. No. 12

Services & Instruction

Book

PILOTS: Examination tests in all grades fully covered with questions and answers. Order "Aeronautical Training" (Just revised) today. $2.00 postpaid or C.O.D. Quiz System, 1455 Flower St., Glendale, Calif. No. 13

Wanted

WACO F 2 fuselage, good condition, give history and lowest cash price. Werpe, Inc., Box 385, Tupper Lake, N. Y.

Instrument Training

Wanted, (cont'd)

To buy a damaged but repairable ship. Aeronca, Stinson, Waco, Fairchild or Beechcraft. Quote with full particulars. State Trade School, Putnam, Connecticut.

Wanted to lease by the month large or small Land or Seaplane. Mike Omedeo, Gesport, New York.

Pair of floats used for 1934 Waco tour place cabin plane, model YKC. Advise lowest cash price, age and condition. N. D. Butler, 2005 L Street NW, Washington, D. C.

OX or Kinner—Bird Less Engine—Landing gear and wings for same. Send list parts and price. W 501, Aviation, 330 West 42nd St., New York City.

Wanted Instruments: Sperry Gyro Horizon, Turn and Bank Indicators, Rate of Climbs, Sensitive Altimeters and Compasses. W 502, Aviation, 520 N. Michigan Avenue, Chicago, Ill.

Employment

Positions Vacant

AERO DYNAMICS INSTRUCTOR Western approved school wants Aero Dynamics instructor who can also assist in licensing of experimental aeroplanes. P 496, Aviation, 383 Mission St., San Francisco, Calif.

DIRECTOR WANTED for new Aviation Mechanics School, New York City. Excellent opportunity. State qualification, references in first letter. P 497, Aviation, 330 West 42nd St., New York City.

(See also ad of Indiana Air Service on page 108)

Positions Wanted

YOUNG MAN, 23, desires work exchange Commercial Flying course. Free to travel. Keep Books, type, anything. Excellent references. F. E. D. Jr., Shady Nook, Atwater, Calif.

AERONAUTICAL ENGINEER MIT graduate—20 years varied technical and executive experience. Now employed. Desires position as chief engineer. PW 495, Aviation, 330 West 42nd St., New York City.

YOUNG MAN, 18, desires work exchange flying instruction, interested parachute jumping. B. D. Tillett, Jr., Winchester, Va.

AVIATION EXECUTIVE 15 years experience, 8 years sales and promotion, have proven initiative, practical, constructive ability to handle sales, production, factory management, airport or large flying service where net profits are desired results assured. PW 499, Aviation, 330 West 42nd Street, New York City.

Representative Available

MANUFACTURER'S AGENT calling on industrial, electrical and aircraft manufacturers in New England. Interested in acquiring exclusive representation for one additional account. Nationally known established production materials, requiring engineering knowledge, preferred. MA 498, Aviation, 330 West 42nd St., New York City.

Salesmen Wanted

SALESMEN WANTED in every flying school there is an opportunity to make extra money. Write for complete details. Ivanov Studios, 6432 Cass Avenue, Detroit, Michigan.

Business Opportunities

ACTIVE PARTNER wanted with $2500 or will sell Flying Service and Sales in city of 250,000. Established going firm, present owner has other business. BO 500, Aviation, 330 West 42nd St., New York City.

Guaranteed Cub Airplane including Free Flying Course, transportation, board, room, World's Fair ticket $790. $320 down, $49 monthly. Free Booklet. Bennett Air Service, Hightstown (Cubtown), New Jersey.

Excellent Opportunity for one only. Commercial Pilots course, position guaranteed with fixed base operator located in Chicago. $900. Cash required. I 503, Aviation, 520 North Michigan Avenue, Chicago, Ill.

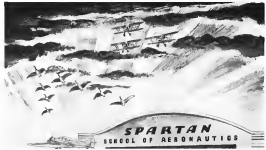
U. S. Government

WAR DEPARTMENT, Material Division, Air Corps, Wright Field, Dayton, Ohio. Office of the Contracting Officer.—The War Department invites the submission in competition of sealed bids covering airplanes under conditions set forth more particularly in the following advertisements: Circular Proposal No. 39-638 dated March 11, 1939, Airplanes, Training (Primary), described in Air Corps Specification No. R 707 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 7, 1939. Circular Proposal No. 39-640 dated March 11, 1939, Airplanes, Bombardment (Two-Engine), described in Air Corps Specification No. C-213 dated January 27, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 5, 1939. Circular Proposal No. 39-640 dated March 11, 1939, Airplanes, Bombardment (Four-Engine), described in Air Corps Specification No. C-212 dated January 27, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 5, 1939. Circular Proposal No. 39-738 dated March 11, 1939, Airplanes, Training (Basic), described in Air Corps Specification No. R-708 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 7, 1939. Circular Proposal No. 39-758 dated March 11, 1939, Airplanes, Training (Advanced), described in Air Corps Specification No. C-832 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 6, 1939. Circular Proposal No. 39-770 dated March 11, 1939, Airplanes, Interceptor Pursuit (Single Engine), described in Air Corps Specification No. C-615 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 8, 1939. Circular Proposal No. 39-775 dated March 11, 1939, Airplanes, Twin Engine, Interceptor Pursuit, described in Air Corps Specification No. C-616 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 8, 1939. Circular Proposal No. 39-780 dated March 11, 1939, Airplanes, Multiplace Fighter, described in Air Corps Specification No. C-818 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 8, 1939. Circular Proposal No. 39-785 dated March 11, 1939, Airplanes, Observation Corps and Division, described in Air Corps Specification No. C-414 dated January 25, 1939, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 8, 1939. Circular Proposal No. 39-800 dated March 11, 1939, Airplanes, Training, Light, described in Air Corps Specification No. R-703 dated October 18, 1938, bids to be submitted to the Contracting Officer not later than 1:00 P. M., Eastern Standard Time, July 8, 1939. Full particulars with respect to said advertisements may be obtained upon application to the Contracting Officer, Wright Field, Dayton, Ohio. (3)

Representative Available

Southern California Aviation Supply firm desires to represent several manufacturers of Products used in the production of aircraft. Have established business and contacts.

AVIATION DYCER SUPPLIES



Home of the DAWN PATROL

Occupying two of the largest and most modern Hangars in the United States equipped with modern Classrooms, fully equipped Machine, Sheet Metal and Welding Shops, Radio and Meterology Departments ... equipment is of the most modern type.

Our own private Flying Field in addition to facilities of the Tulsa Municipal Airport one of the highest rated in the country. Modern dormitories and up-to-date Restaurant for student's well being.

Factory affiliations of America place YOU knowledge in the manufacture of SPARTAN All-Metal Executive and Military Conversion 7W-F Airplanes.

Spartan Approved Repair Station No. 50 further increases your knowledge of ALL types of airplanes, engines and equipment.

YOU FLY THE ALL-METAL EXECUTIVE AT SPARTAN

Modern Training at Lower Cost

THE wide awake ambitious young men who ARE THE DAWN PATROL come from every section of the United States and many foreign countries. Many of them coming half way 'round the World to SPARTAN because of the International Leadership Spartan Training has acquired. Here they enjoy the most naturally IDEAL flying country in the world with hundreds of miles of flat level country stretching to all directions. Nature's landing field without hazards of mountains or factory and other obstructions adjacent to large cities. Weather that is free from ocean fogs and city haze and smoke. Here YOU enjoy the facilities, equipment and trained personnel that have made this pioneer school outstanding in the early aviation training of hundreds of young men who today command important positions in the Aviation Industry. Like these young men who will leave SPARTAN equipped with Training to fit them for ANY JOB IN AVIATION! . . . a place is waiting for YOU in the DAWN PATROL—*the opportunity for YOUR future in Aviation.*

SPARTAN HOME OF THE DAWN PATROL SCHOOL OF AERONAUTICS

IN THE Tulsa CENTER of Nature's IDEAL Flying Country

SPARTAN SCHOOL OF AERONAUTICS, P. O. Box 2649, TULSA, OKLAHOMA

Send me a copy of the NEW 1939 SPARTAN Catalog and Supplement describing in detail Spartan Flying Mechanical and Radio Courses of Aeronautics. Tuition and detailed living expenses.

NAME AGE

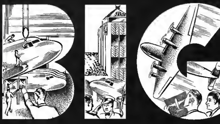
ADDRESS CITY STATE

Any Previous Flying Experience?

Check below branch of aeronautics you are most interested in

- ☐ FLYING
- ☐ MECHANICAL
- ☐ RADIO INSTRUMENT
- ☐ EXECUTIVE-MANAGEMENT

CURTISS-WRIGHT TECH
trains You for the



JOBS IN AVIATION

We are not training our students to drive rivets all their lives. Curtiss-Wright Tech training is all designed to prepare its students to occupy responsible supervisory positions. Our hundreds of successful graduates prove that Curtiss-Wright Tech training gets results and always pays—it has provided them with a profitable occupation and a secure future career. Curtiss-Wright Tech's two major courses, AERONAUTICAL ENGINEERING and MASTER MECHANIC, are complete career courses and are carefully planned to train you in advance for the highest position you ever expect to occupy.

CURTISS WRIGHT TECHNICAL INSTITUTE
ESTABLISHED 1929 — C. C. MOSELEY, PRES.

GRAND CENTRAL AIR TERMINAL • GLENDALE (LOS ANGELES), CALIFORNIA

Without cost or obligation send me full information and catalog on the course checked below

Major Career Courses	Supplementary Courses	Home Study Courses
☐ AERONAUTICAL ENGINEERING	☐ POST GRADUATE ENGINEERING	☐ AERONAUTICAL DRAFTING
☐ MASTER AVIATION MECHANICS	☐ AIRCRAFT SHEET METAL	☐ BLUE PRINT READING

NAME____ Age____ Date I plan to Enroll____

ADDRESS____ City____ State____ AV 5

Small student groups allow personal supervision of all engineering training by Stanley H. Evans Director of the Engineering School.

"THERE *IS* A DEMAND FOR THE . . . *PRACTICAL* TRAINED AERONAUTICAL ENGINEER"

RYAN'S two-year engineering course—with 3500 hours of theoretical and practical instruction—has been specifically designed to meet the industry's needs

Director in charge of this Division is Stanley H. Evans, whose twenty one years of affiliation with aviation as war time pilot design engineer and educator, assures Ryan students that their curriculum and personally supervised instruction will meet present day demands

LEFT—The design of a rib by engineering students is followed by rib construction and actual static load tests. RIGHT—Practical training for the Ryan engineering student includes engine installation problems.

Here the engineering student, whose future work must necessarily be closely related to aircraft manufacturing and flight problems, has opportunity for the direct two-year association between basic theory, practical design and applied research, coupled with shop practice, that is available only at Ryan through the school's close affiliation with the Ryan Aeronautical Company

Theory alone is not sufficient. The aircraft industry is in search of young men who through a course of this type have proven their ability as Junior Engineers and Draftsmen and have the necessary first-hand contact with the practical problems of metal aircraft manufacture.

The aviation industry is not as interested in academic degrees as in practical training. At Ryan you learn HOW as well as WHY. Whether you enter the profession of aeronautical engineer fresh from a five-year college course or from a practical two-year professional engineering course, such as Ryan offers, your starting position will be the same. Advancement will depend on you—but remember—the two-year technical graduate will have had three years of additional practical experience in the industry before the college man will have finished his training

The aircraft industry has launched the greatest development program in its history. You can take part in this program if you prepare yourself with this training which the industry recognizes as essential

Write for the Ryan prospectus and arrange now either for immediate enrollment, or for the summer term opening July 3rd.

RYAN SCHOOL OF AERONAUTICS
FLYING ★ MECHANICS ★ ENGINEERING

MODERN training planes are as important as adequate instruction. Ryan's fleet of training ships is the most modern of any school in America. Primary trainers used are trim Ryan S-T-As like the one above. Cabin planes include the new Ryan S-C.

RYAN SCHOOL OF AERONAUTICS • Lindbergh Field, San Diego, Calif.
As 5
Please send information on courses checked.

FLYING COURSES
☐ Master Pilot
☐ Commercial
☐ Limited Commercial
☐ Private
☐ Solo

☐ Deluxe Combination—includes a new Ryan S-T-A plane with complete commercial course

TECHNICAL COURSES
☐ Aeronautical Engineering

☐ Airplane Drafting and Design
☐ Master Mechanic
☐ Master Mechanic and Flying
☐ Aircraft Welding
☐ Advanced Navigation
☐ Master Radio

Name__________ Age_____

Address__________

City and State__________

Please Print or Type

Nature Favored this Aviation Training Center

Where 97% of Graduates Are Employed by the Industry

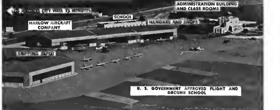
Western Air College operates Alhambra's beautiful $1,300,000 Airport, located practically in the center of the area in which fully 50% of the nation's aircraft is built.

Here, amid ideal surroundings where 352 days a year are flying days, special attention is given to the type of training that assures the graduate AVIATION employment.

Ninety-seven percent of Western Air College graduates have secured employment within the industry.

Located on the same field, immediately adjacent to Western Air College, is the factory of the Harlow Aircraft Company, builder of a new and sensational private transport.

Here, also, is the shipping unit where the famous Lockheed bombers are being prepared for shipment to England's Royal Air Force.



Headed By Men Who Know

Lieutenant Kenneth C. Hawkins, the President of Western Air College, was graduated from the U.S. Naval Academy at Annapolis in 1919 with a degree of Bachelor of Science. In 1929 he resigned from the Navy to pioneer the New York, Rio de Janiero & Buenos Aires air line, later acquired by Pan-American, and was for several years maintenance engineer of Pan-American Grace line down the west coast of South America. Prior to his resignation, he headed the Naval Cadet school at San Diego. He personally selects the heads of the various departments and all flying instructors must meet air line requirements.

WESTERN AIR COLLEGE

LIEUT. KENNETH C. HAWKINS, *President*
Alhambra Airport, Alhambra, California

Lieut. Kenneth C. Hawkins,
Western Air College,
Alhambra Airport, Alhambra, California
Dear Sir

Please send me, without obligation on my part, your illustrated booklet. I am interested in the courses checked below

Flying:
☐ Commercial Pilot
☐ Limited Commercial Pilot
☐ Private Pilot
☐ Solo Pilot

Ground:
☐ Aeronautical Engineering
☐ Master Mechanic
☐ Airplane Craftsman
☐ Drafting, Home Study

Name__________ Age_____

Address__________
(Street) (City) (State)

Yrs. in High School_____ Yrs. in College_____

Dart's most enthusiastic salesmen are those who have investigated and then invested in this surprising aircraft value. They take their pay in pride of possession plus the knowledge that they are recommending a truly trustworthy ship.

The next time you see a Dart at any airport, introduce yourself to the owner. Ask him why he is so confident in its easy operation, utter stability, and extraordinary flexibility. Look the ship over, note its simplicity of design, super-sturdy construction, up-to-the-minute equipment. Then ask about cost of operation. You'll get the most pleasant shock of your flying career!

Two-place, 90 h.p. Powered by Ken-Royce, 110 to 135 m.p.h. For commercial, sport or student flying.

Desirable sales territories available to established domestic or foreign distributors.

CULVER AIRCRAFT CORP.
PORT COLUMBUS — COLUMBUS OHIO

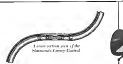
INDEX TO ADVERTISERS

SCHOOLS

AVIATION'S MARKET PLACE

(CLASSIFIED ADVERTISING)

(CLASSIFIED DISPLAY ADVERTISING)



A cross section view of the Simmonds-Corsey Control

The Simmonds-Corsey Control is contained within a tube, which can be bent to any desired shape, permitting installation without changing the position of any other equipment to accommodate it. It is the only flexible control where complete inspection is practical during normal routine maintenance. This low friction, backlash free flexible, push-pull control will give trouble-free operation throughout the life of any airplane. Simmonds-Corsey Controls are used for throttle, mixture, propeller, spark, supercharger, slot locks, carburetor air heat, cowling flaps, wobble pumps, fuel cocks, dump valves, etc. Our Engineering Staff specializes in helping to solve control problems. They will be glad to assist you, without obligation.

Wondegrip used as wingwalks on The Dart

Simmonds Wondegrip is a non-slip, non-ignitible aircraft floor covering especially designed for use on wingwalks and in pilots' or gunners' cockpits, cabins, and so forth. It retains its slip proof qualities whether wet or dry. Lighted cigarettes will not ignite Wondegrip. Its wearing quality has been tested by actual use on planes for a number of years and the ease with which it can be installed and kept clean adds greatly to its superiority over other forms of floor covering. Although strong and endurable Wondegrip is very light in weight and thus can be used for every purpose where a reliable flooring is needed. It is obtainable in various colors, widths and thicknesses. Send for samples and prices.

Simmonds Corsey Controls and Wondegrip Flooring have long been standard equipment on British aircraft and have recently been adopted by leading Canadian and American aircraft manufacturers. Both Simmonds Corsey Controls and Wondegrip Flooring are now made in America.

SIMMONDS AEROCESSORIES, INC.

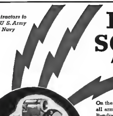
Designers and manufacturers of specialized aeronautical and engineering accessories

551 FIFTH AVENUE • Dept. D • NEW YORK, N. Y.

Contractors to the U. S. Army and Navy

BENDIX-SCINTILLA

AIRCRAFT MAGNETOS



On the engines of every commercial airline, and of all arms of the United States government service, Bendix-Scintilla Aircraft Magnetos have long been the approved ignition equipment. The preponderance of civilian aircraft, too, are Scintilla-equipped.

This preferment is traceable directly to Scintilla's efficiency and reliability and a reputation that no amount of pressure in the interests of price or production hurry will ever jeopardize.

SCINTILLA MAGNETO
DIVISION OF BENDIX AVIATION CORPORATION
Sidney, New York

THE NEW PAN-AMERICAN CLIPPERS BY BOEING

Eclipse-Equipped

ECLIPSE PRODUCTS ON THE NEW BOEING "314"

Engine Starters ★ D. C. Generators ★ A. C. Generators ★ D. C. and A. C. Dynamotors Propeller Feathering Hydraulic Pumps Propeller Feathering Hydraulic Pressure Selector Valves ★ Carburetor Air Temperature Controls ★ Flap Operating D. C. Motors Mechanical DeIcer Pumps ★ Remote Indicating Flowmeters ★ Propeller Governor Remote Controls ★ Fluid Check Valves Solenoid Relays ★ Ignition Booster Coils.

THE natural pride which all America takes in the new Boeing "314" Pan-American Clipper Ships is shared by Eclipse. These magnificent 74 passenger flying boats—largest passenger airplanes to be placed in service in the World, powered with four 1500 horsepower Wright Cyclone engines, most powerful of their type, carry many units of Eclipse manufacture.

Years of satisfactory service has warranted this renewal of confidence and Eclipse is justly proud of this enviable record.

ECLIPSE AVIATION
DIVISION OF BENDIX AVIATION CORPORATION
BENDIX, NEW JERSEY